Academy of Innovative Semiconductor and Sustainable Manufacturing

ANALOG INTEGRATED CIRCUIT DESIGN AND LAYOUT LAB

MOSFET CHARACTERISTIC CURVE

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LAB2-1-1a. CLASSIC NMOS I_{DS} – V_{DS} CURVE

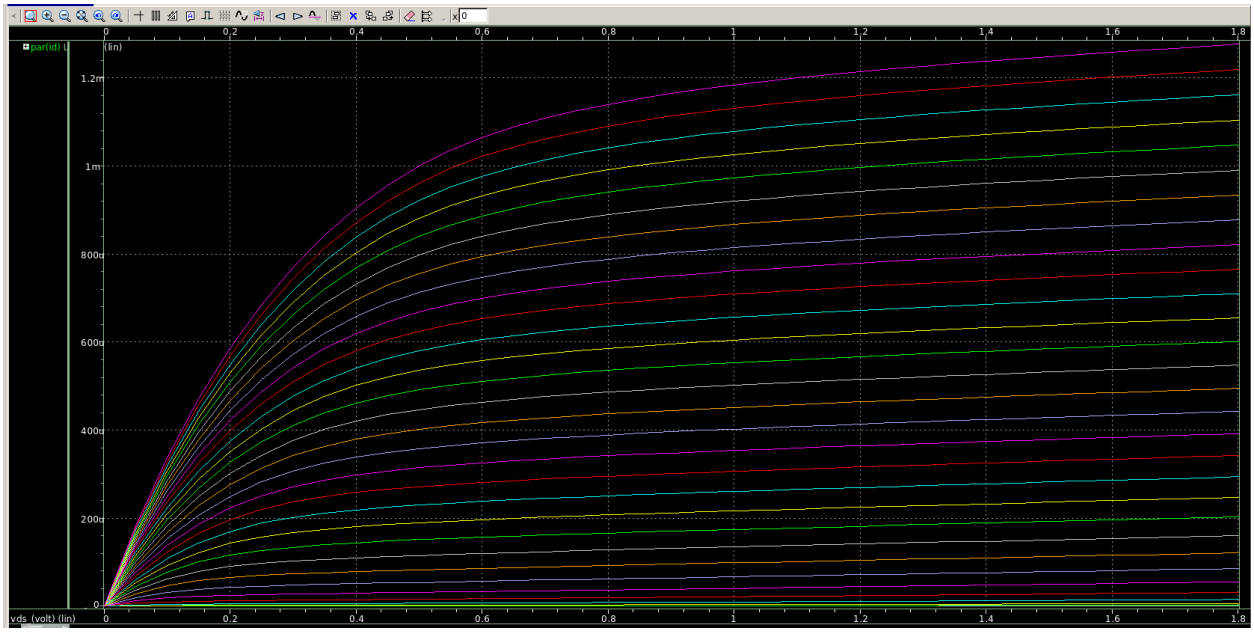

Figure 1. NMOS I_{DS} – V_{DS} CURVE

Comment:

- From Figure 1, we can guess that V_{TH} will be around 0.4V.

- When $V_{DS} < V_{GS} - V_{TH}$, the curve (V_{GS}=0 and 0.2) is nearly the same curve *(Cut of to linear region)*.

- When V_{DS} increases, NMOS operates in triode region, the function of I_D respect to V_{DS} is a squared function.

- If $V_{DS} > V_{OV} = V_{GS} - V_{TH}$, NMOS operates in saturation region, the function of I_D respect to V_{DS} is a linear function with slope of λ.

- With each higher V_{GS}, we get a higher V_{OV}, so the saturation region corresponding to the higher V_{GS} occur later as V_{DS} increases. Additionally, with a higher V_{GS}, I_D is also greater.

LAB2-1-1b. CLASSIC PMOS I_{DS} – V_{DS} CURVE

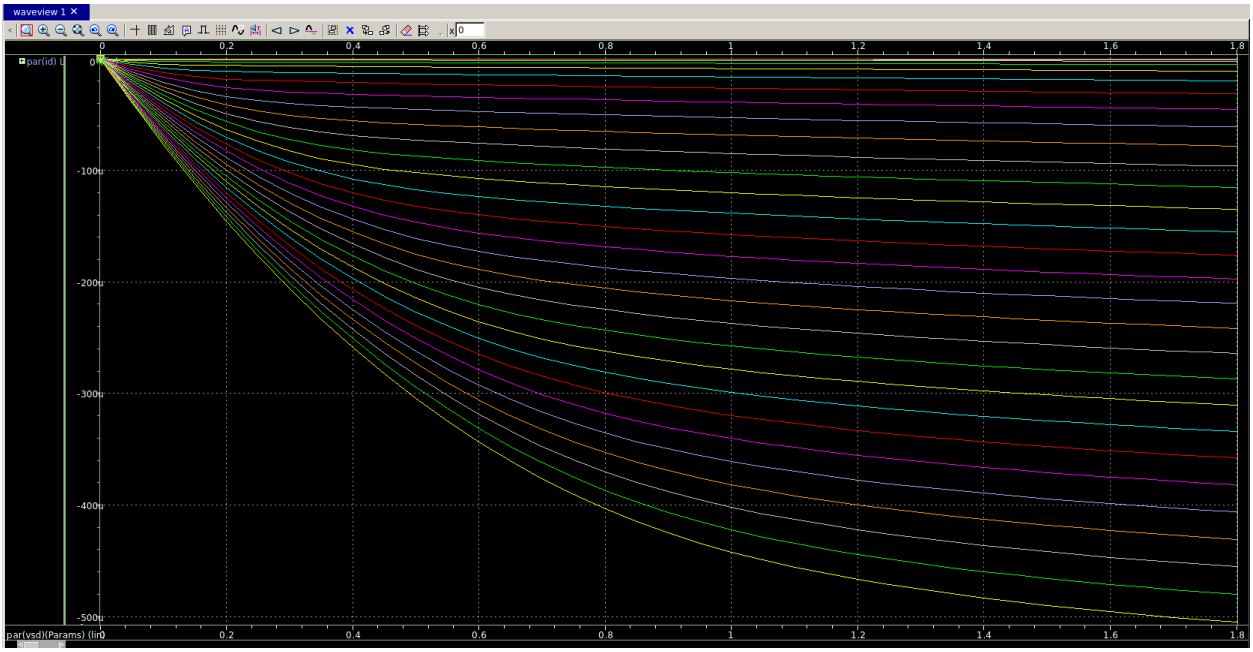

Figure 2. PMOS I_{DS} – V_{DS} CURVE

Comment:

- From Figure 2, we can guess that V_{TH} will be around 0.4V.

- When $V_{SD} < V_{SG} - V_{TH}$, the curve (V_{GS}=0, 0.2 and 0.4) is nearly the same curve *(Cut of to linear region).*

- When V_{SD} increases, PMOS operates in triode region, the function of I_D respect to V_{DS} is a squared function.

- If $V_{SD} > V_{OV} = V_{SG} - V_{TH}$, NMOS operates in saturation region, the function of I_D respect to V_{DS} is a linear function with slope of λ.

- With each higher V_{SG} , we get a higher V_{OV}, so the saturation region corresponding to the higher V_{SD} occur later as V_{SD} increases. Additionally, with a higher V_{SD}, I_D is also greater. The current ID in PMOS has a negative sign because it flows in the opposite direction compared to NMOS.