MODEL PARAMETER EXTRACTION WORKSHEET

NOTE: For any other device lengths, re-plot characterization curves and repeat this work sheet to extract model parameters for hand calculations. Keep in mind that the accuracy of device models will worsen in sub-micron regime.

Preliminary Preparation

Module 2 – Lectures 9 and 13

Objective

Extract the thinking model parameters for the MOSFET in strong and weak inversion.

Strong Inversion Model

The thinking model for the strong inversion NMOS is given as

$$i_D = \frac{K'W}{2L}\left(v_{GS} - V_T\right)^2 (1 + \lambda v_{DS}) \qquad (1)$$

The parameters of this model are K', V_T, and λ. There is a further model that gives the dependence of V_T on V_{BS}, however this model will be ignored in this exercise.

For the PMOS model, use the NMOS model with the directions of the currents and voltages reversed.

Exercise

1.) Extract the parameters K' and V_T for the NMOS thinking model from Figure 1. The value of W = 10µm and L = 2µm. Extract these parameters for 1V < V_{GS} < 2V.

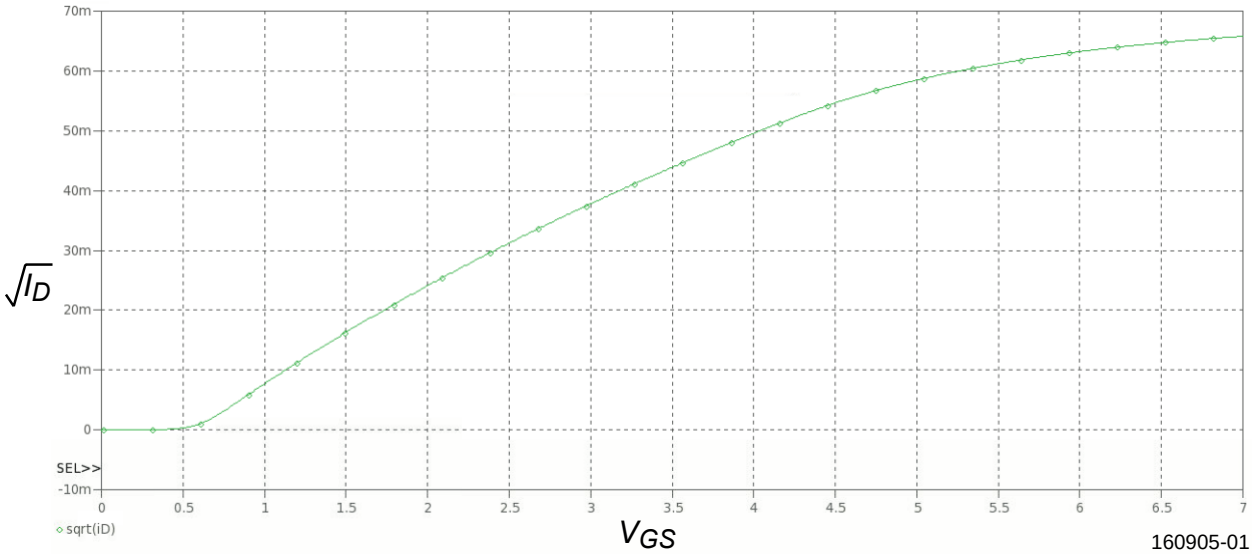

Figure 1 – Sqrt (i_D) versus V_{GS} for NMOS with W = 10µm and L = 2µm.

2.) Extract the parameter λ from Figure 2. Do the extraction in the range of 1V < V_{DS} < 3V.

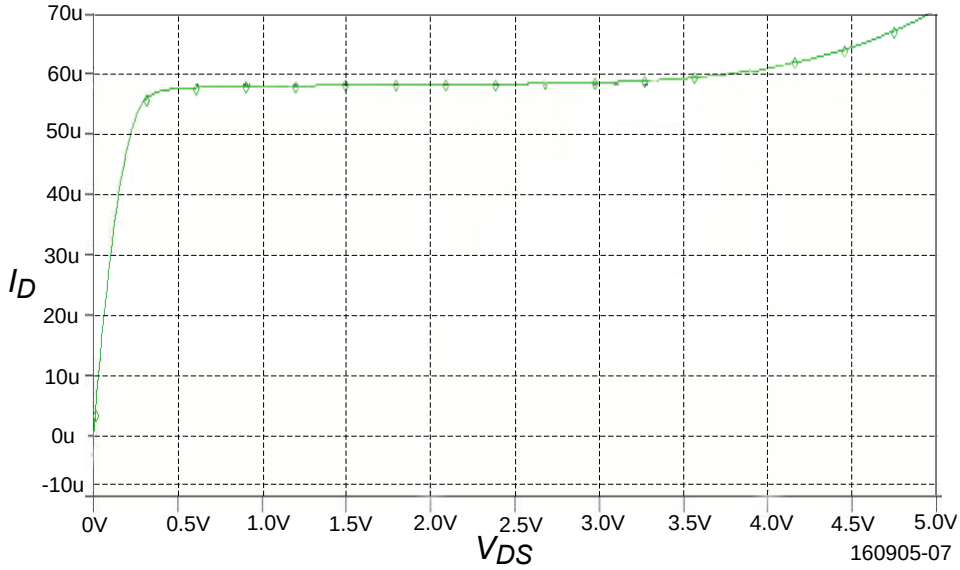

Figure 2 – i_D versus V_{DS} for NMOS with W = 10µm and L = 2µm and V_{GS} = 1V

3.) Repeat 1.) for PMOS

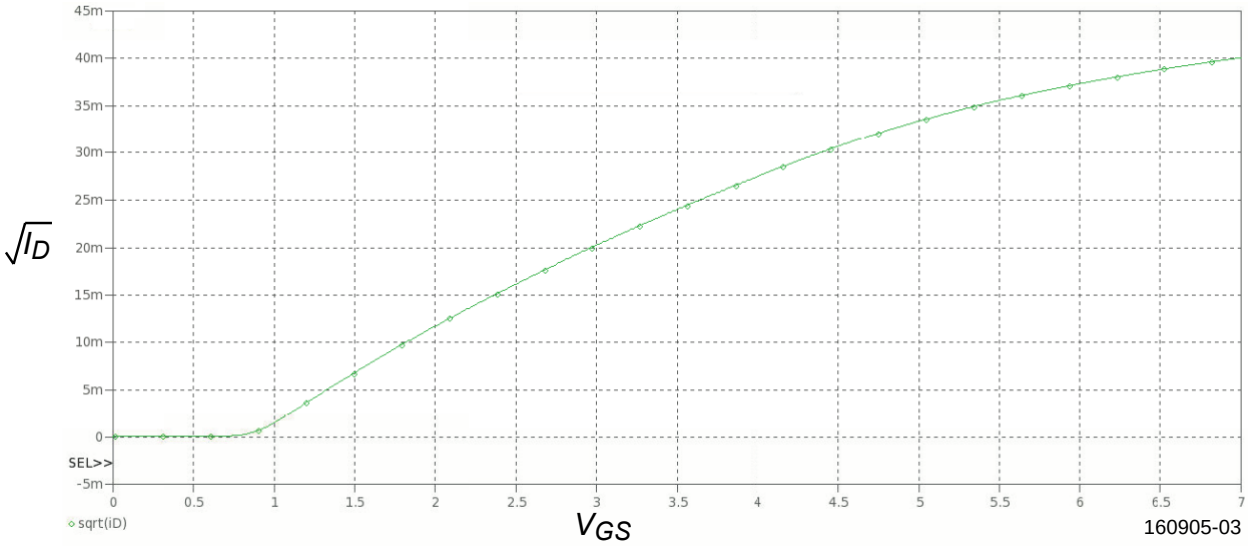

Figure 3 - Sqrt (i_D) versus V_{GS} for PMOS with W = 10µm and L = 2µm.

4.) Repeat 2.) for PMOS.

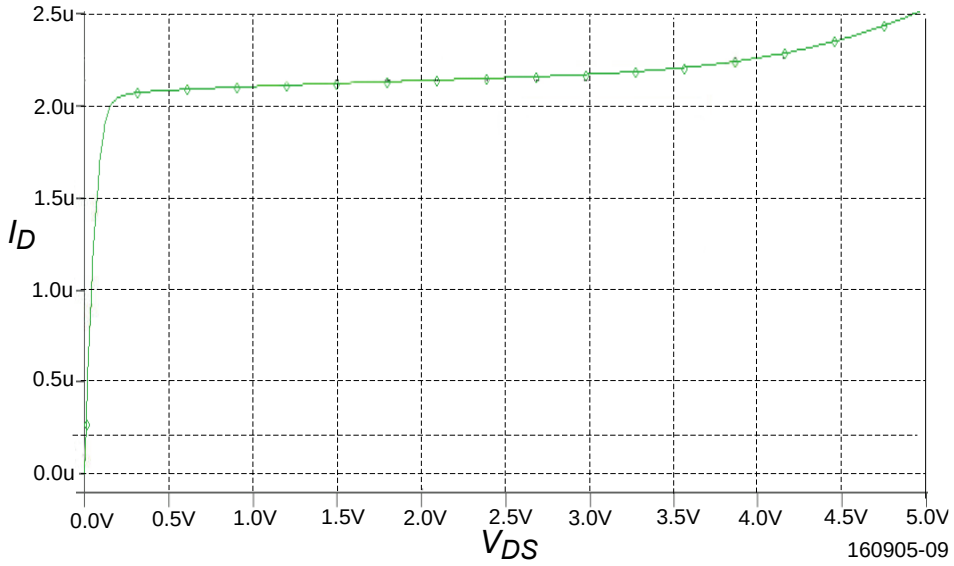

Figure 4 – i_D versus V_{DS} for PMOS with W = 10µm and L = 2µm and V_{GS} = -1V,

Summary

Fill in the values for the following table.

	K'	Units	V_T	Units	λ	Units
NMOS Strong Inversion						
PMOS Strong Inversion						