

HSPICE Homework #1 of 「類比積體電路導論」

作業繳交截止日期: **Sep. 26, 2024** (上傳E3 數位平台繳交)

According to the following schematic, perform the HSPICE simulation using the NMOS device(**n_18_mm**) parameters of 0.18um CMOS technology to obtain the I-V curves.

此 SPICE simulation，需使用課程指定的 U18 製程參數進行模擬與計算

Write a report with HSPICE files and simulation results according to the following works:

(1) Compare the I-V curves and make comments on their differences (corners & size).

(附上各Corner波型結果及完成以下表格並做描述)

Corner	TT	SS	FF
$I_D @ V_{GS} = V_{DS} = 1.8V$ $W/L=5.4\mu m/1.8\mu m$	(a)	(c)	(e)
$I_D @ V_{GS} = V_{DS} = 1.8V$ $W/L=0.54\mu m/0.18\mu m$	(b)	(d)	(f)

(2) Compare the simulated current and the calculated current at different conditions and make comments on their differences. (Corner : TT)

(V_{th} 可以用 $V_{th0}(V)$: threshold voltage , $\mu_0(\text{cm}^2/\text{V/s})$: channel mobility , $t_{ox}(m)$: gate oxide thickness , (設 SiO_2 介電系數為 3.9) , 相關參數請去製程檔 ./mm180_reg18_v124.lib and ./mm180_reg18_v124.mdl 查看)

(a) $V_{GS}=1.8V$, $V_{DS}=1.8V$, $W/L=5.4\mu m/1.8\mu m$

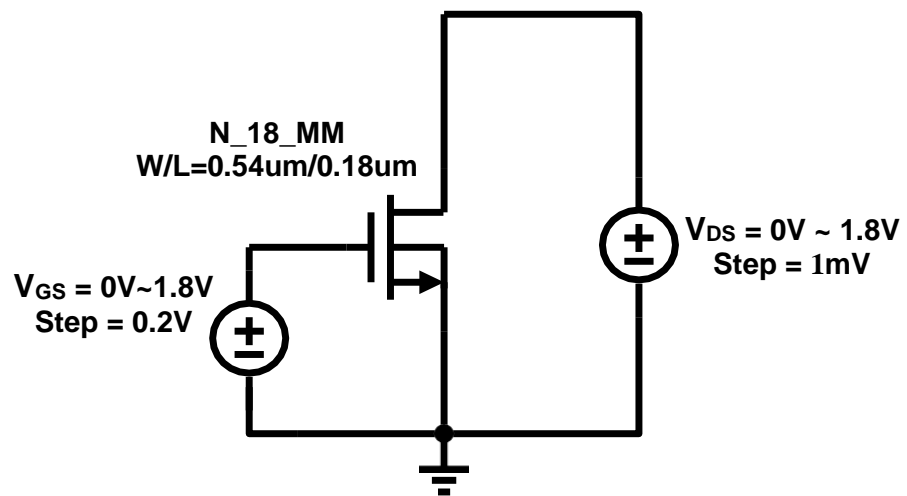
(b) $V_{GS}=0.8V$, $V_{DS}=1.8V$, $W/L=5.4\mu m/1.8\mu m$

(c) $V_{GS}=1.8V$, $V_{DS}=1.8V$, $W/L=0.54\mu m/0.18\mu m$

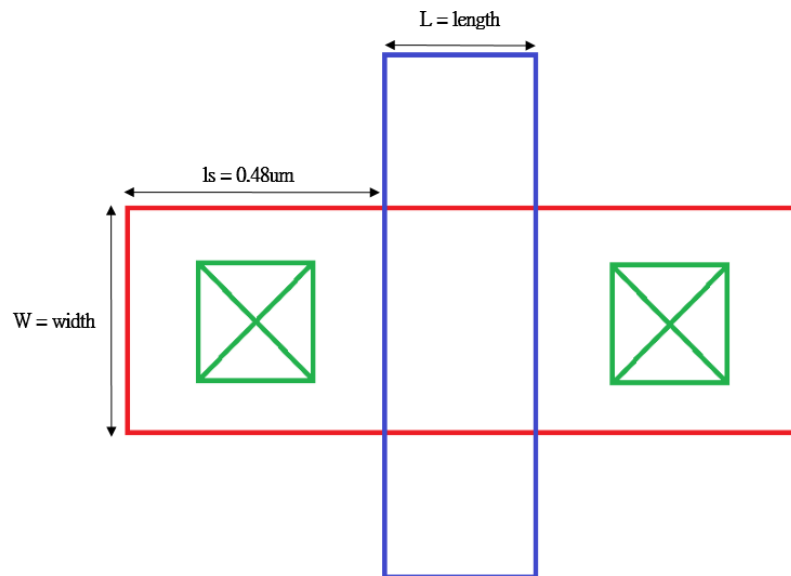
(d) $V_{GS}=0.8V$, $V_{DS}=1.8V$, $W/L=0.54\mu m/0.18\mu m$

	Sim.	Cal.
$I_D @$ (a)		
$I_D @$ (b)		
$I_D @$ (c)		
$I_D @$ (d)		

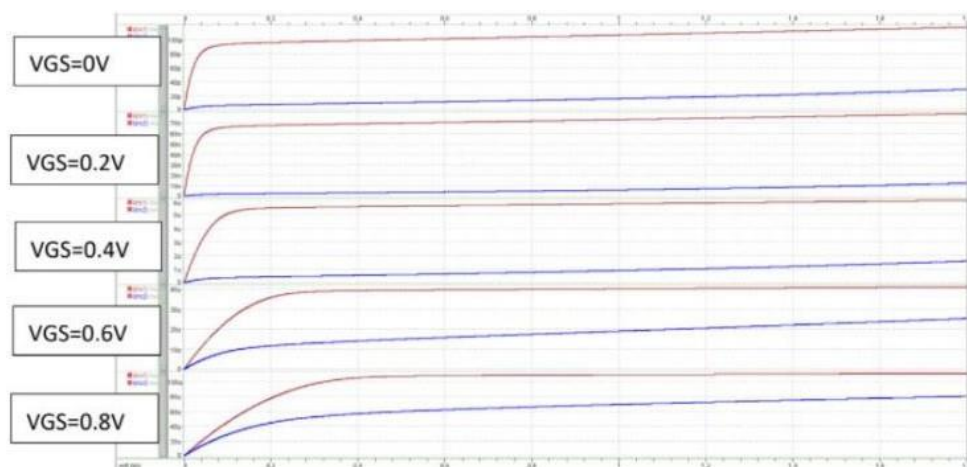
(3) Describe the channel-length modulation effect and velocity saturation effect based on the simulation result. Also, plot the I-V curves under the TT corner with V_{GS} and V_{DS} ranging from 0V to 1.8V. (Please add AS, AD, PS, and PD and make comments on the differences)

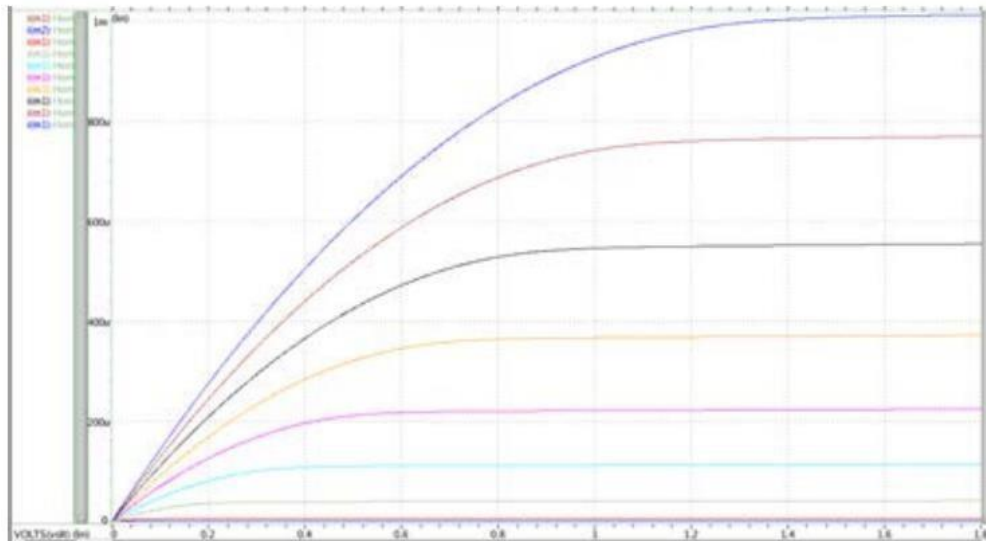


Drain/Source Area: $A_S=A_D= l_s \cdot W$ Drain/Source
Perimeter: $P_S=P_D= 2l_s+W$



此次作業 simulation 波形兩種呈現方式供參考，橫軸為 V_{DS} ，縱軸為電流大小，每條波形代表不同 V_{GS} 。





HSPICE_HW1：作業需要有以下幾點：

1. HSPICE Code (截圖)
2. Simulation Results (波形繳交背景請用白色，並且波形標示和呈現要清楚)
3. 每個小題的單獨說明(敘述題有寫到重點即可得到全部分數)

問題(1) 結合波形+表格+說明

問題(2) 列出比較表格+說明 (所有相關參數請去製程檔查看)

問題(3) 波形+說明

4. 以.pdf 的格式上傳
5. 檔案名稱用「Hspice_HW1_自己的學號」(例如：Hspice_HW1_0811541)，於作業繳交截止日期(發布後隔週禮拜四晚上 6 點)前，上傳到指定的 E3 數位平台繳交，遲交一周內打八折，一周後不計分。

WaveView Settings:

DO NOT HAND IN YOUR WAVEFORM WITH BLACK BACKGROUND !!!

Config -> Preference -> Waveview -> Waveview Background

