TAIWAN TECH NATIONAL TAIWAN UNIVERSITY OF SCIENCE AND TECHNOLOGY

Virtuoso 使用教學

Department of Electronic and Computer Engineering
National Taiwan University of Science of Science and Technology
MSIC Lab

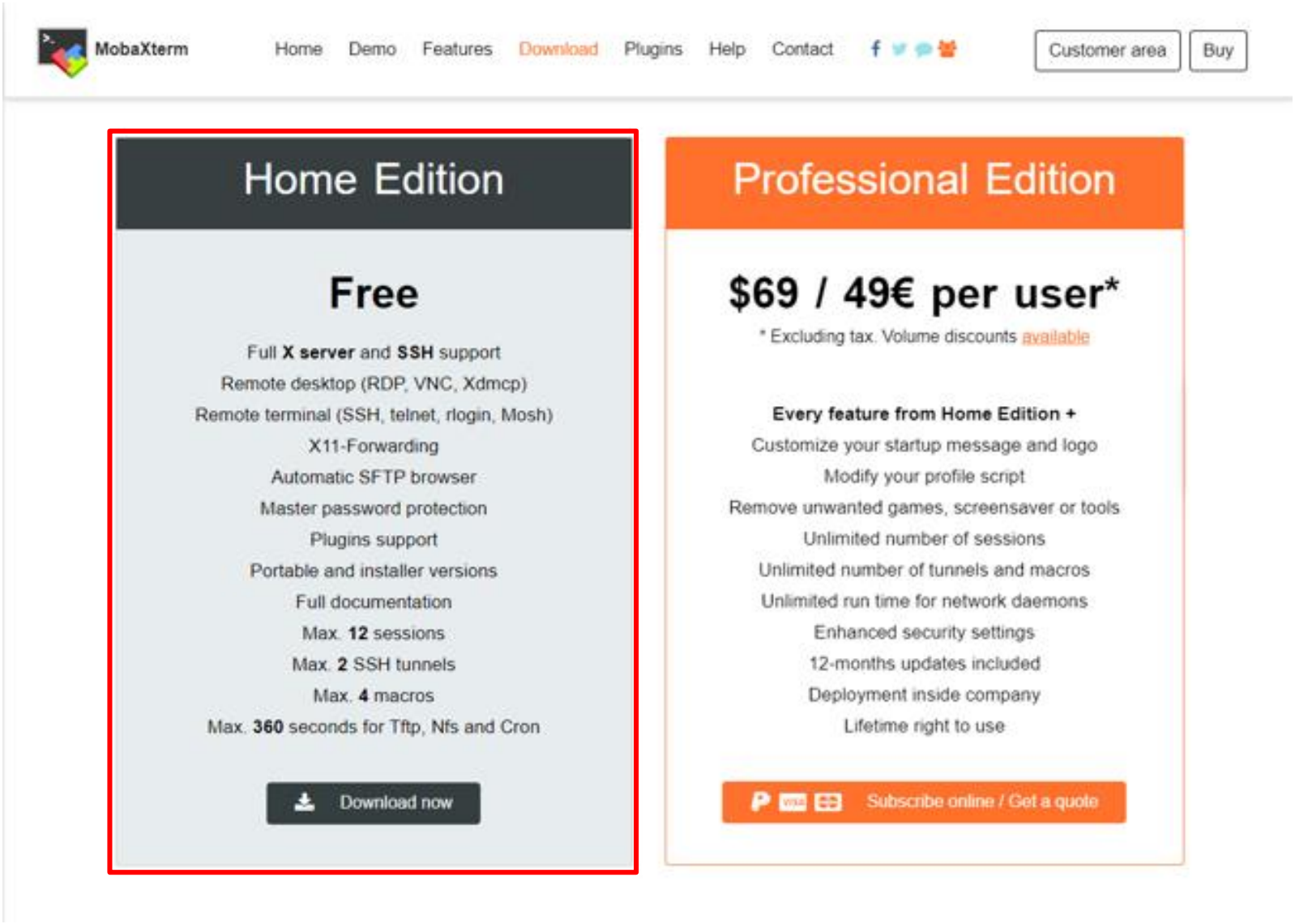
Professor : 鍾勇輝

TA : 郭駿浩、郭哲原

2024/02/21

Analog Integrated Circuit Design and Applications

MobaXterm Download



MobaXterm Download

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Host location

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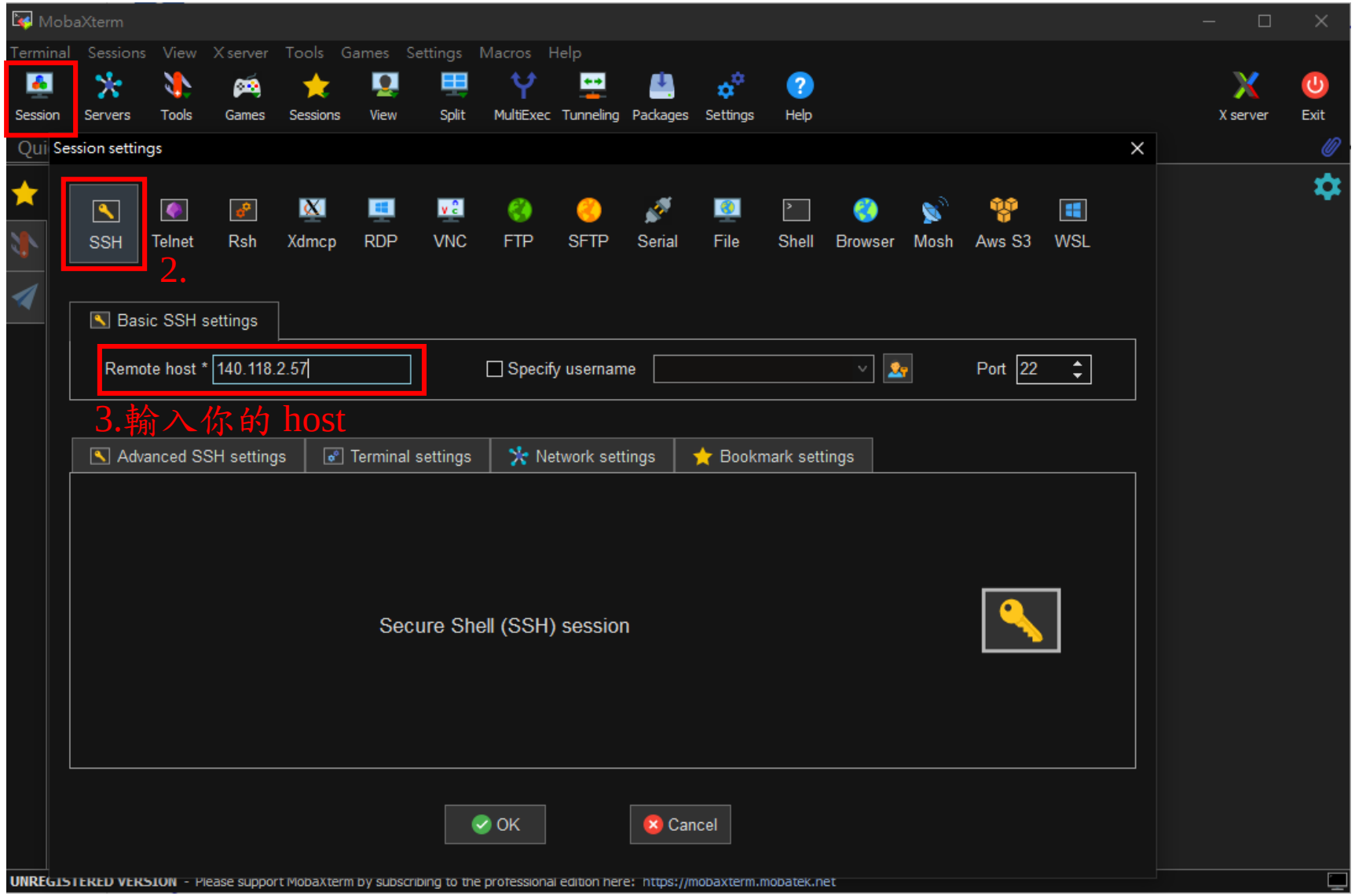
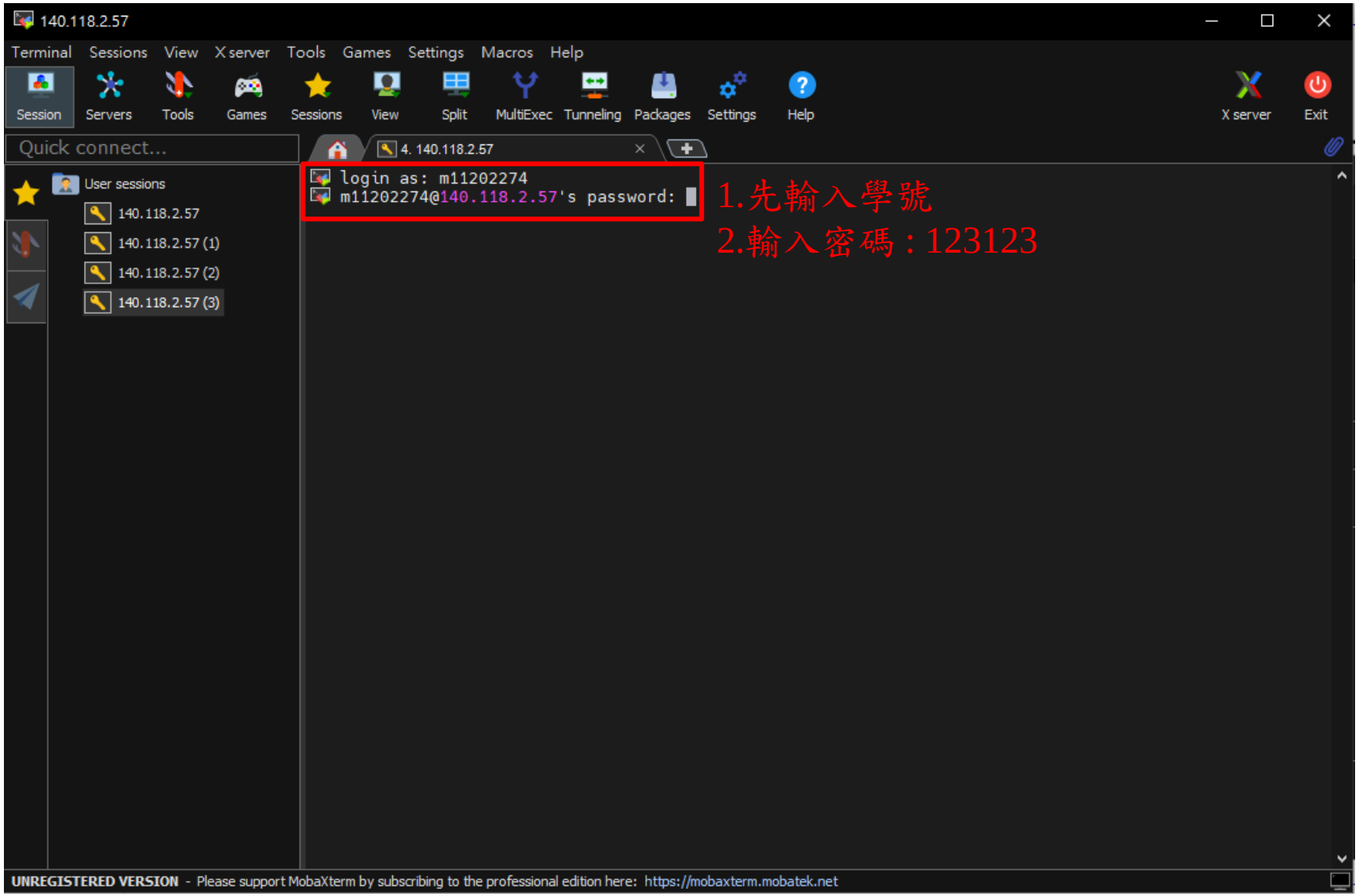
（學號英文小寫）

Use of MobaXterm



Use of MobaXterm



Instructions Introduction

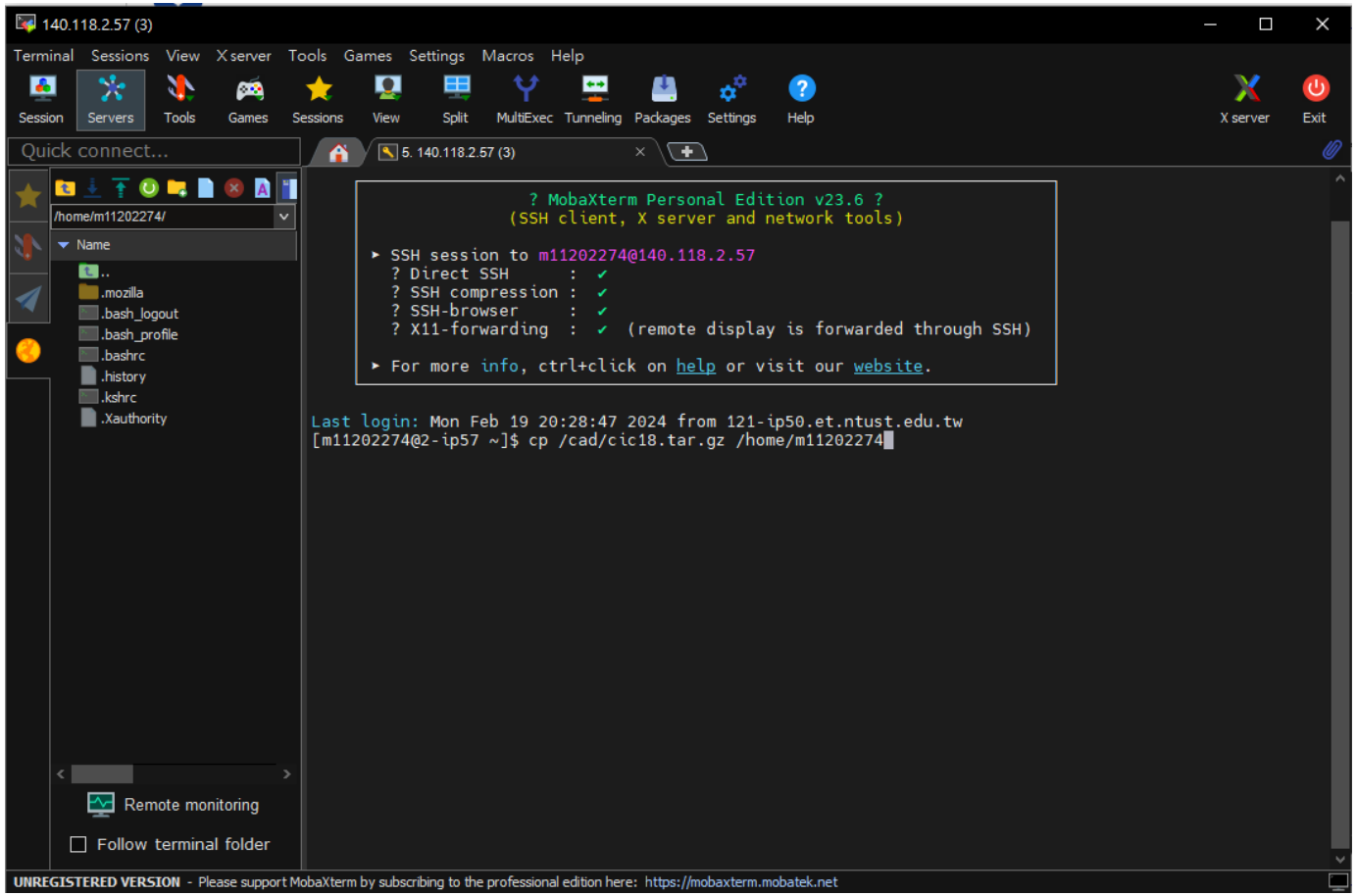
- pwd 顯示terminal目前位置
- cd 目標子目錄 將terminal移動到目標子目錄 ex : cd cic18
- cd 回到使用者家目錄
- cd .. 回到上一層(..代表上一層)
- ls 顯示目前位置內的檔案與子目錄
- ls –a 顯示目前位置內的檔案與子目錄(包含隱藏檔)
- ls -l 顯示目前位置內的檔案與子目錄，並詳列屬性
- touch 檔案名稱 建立新檔案 ex : touch test
- mkdir 子目錄名稱 建立子目錄 ex : mkdir AIC
- rm 檔案名稱 刪除指定檔案 ex : rm test
- rm -r 子目錄名稱 刪除指定子目錄(包含底下檔案) ex : rm -r AIC
- mv 檔案名稱 目標位置 將檔案移動到指定位置 ex : mv test ..
- mv 檔案名稱 新名稱 將檔案變更檔名 ex : test test01

Simulation Environment Settings

1. 輸入 cp /cad/cic18.tar.gz /home/學號（表示將cic18.tar.gz複製到你學號的資料夾中）
2. tar zxvf cic18.tar.gz(將檔案解壓縮)

注意使用複製指令時，要記得空白鍵!!

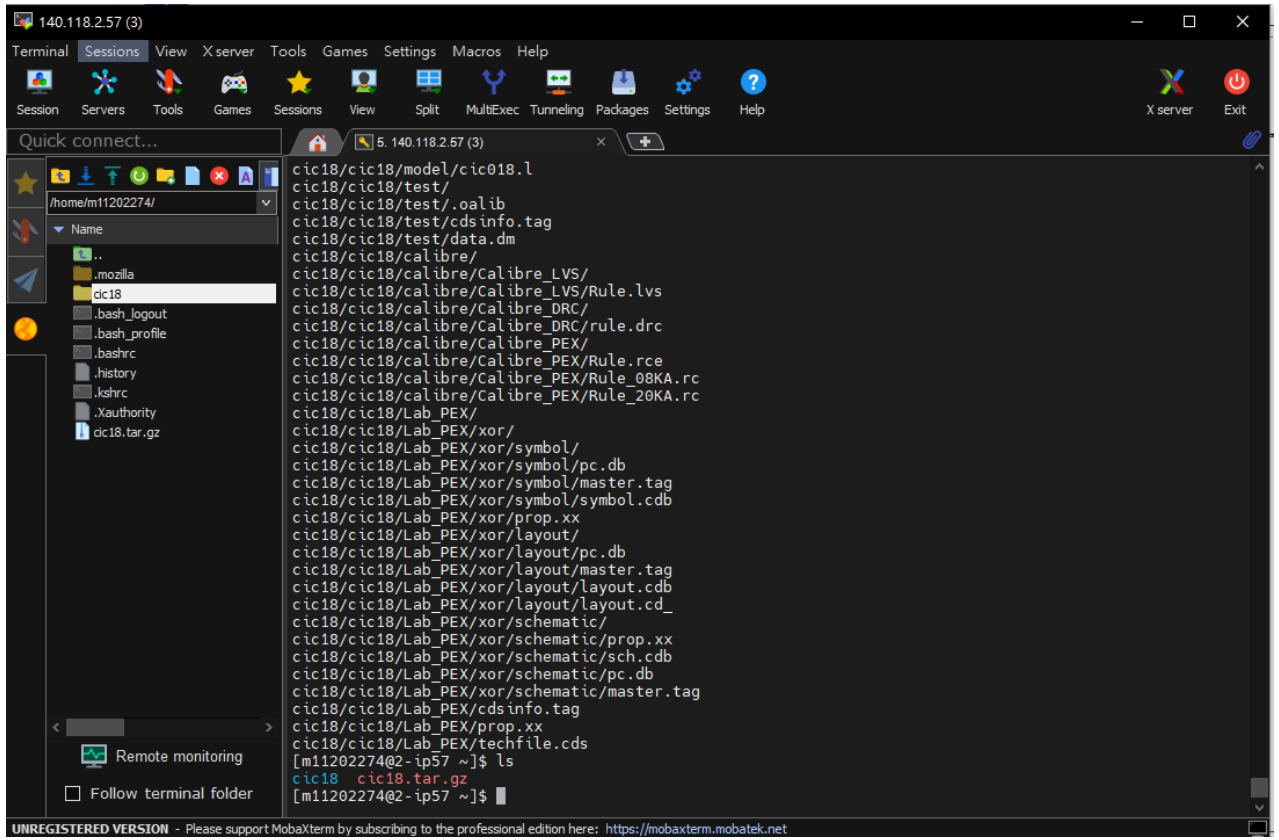
cp（空白鍵）複製的檔案路徑（空白鍵）要複製到的路徑位置



Simulation Environment Settings

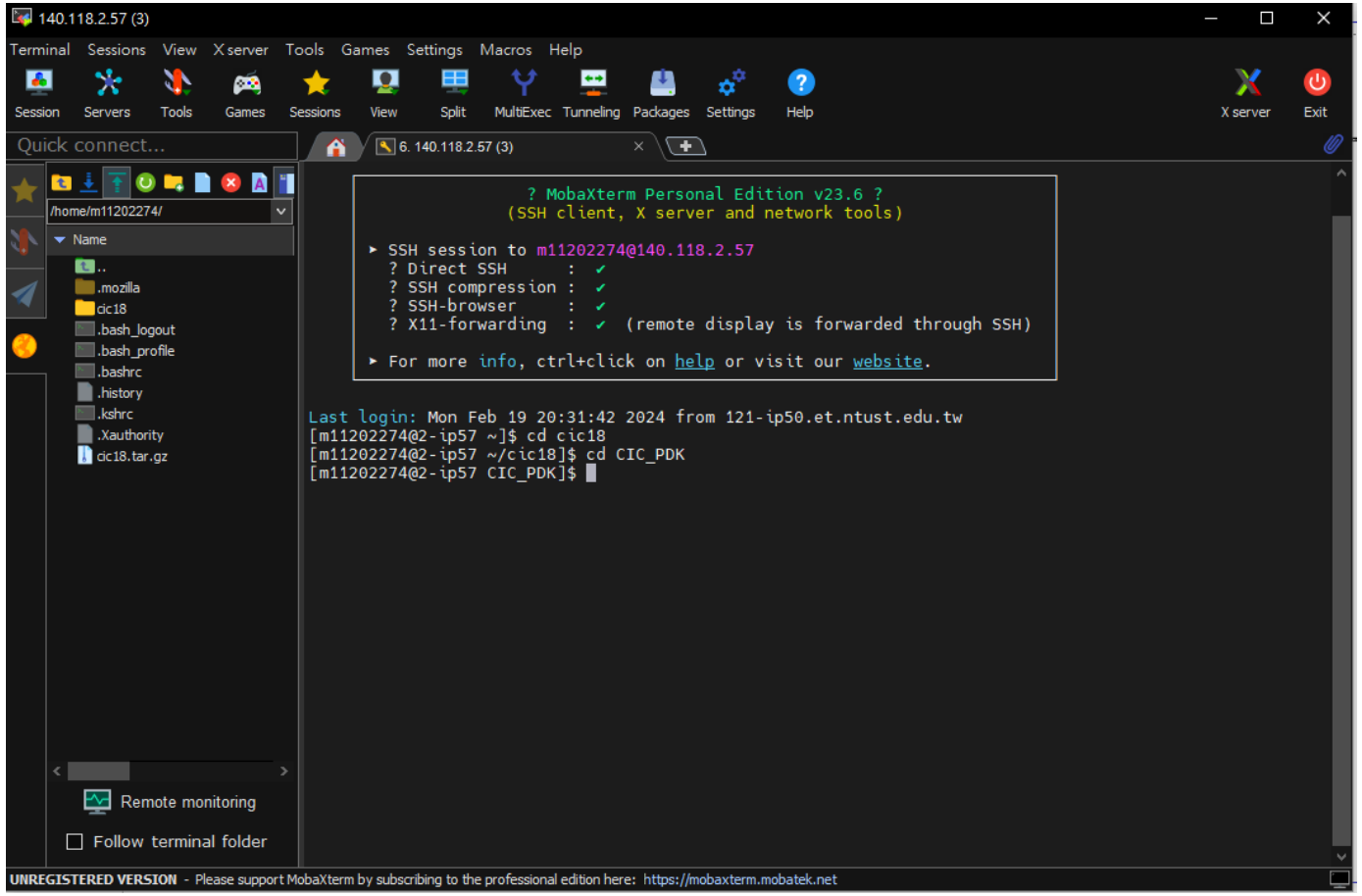
3. 輸入 ls
   （檢查看看cic18檔案是否解壓縮成功）

4. 並輸入下列指令
   將.bashrc、.tcshrc、.cdsinit三個檔案複製到學號的資料夾
   cp /cad/.bashrc /home/學號
   cp /cad/.tcshrc /home/學號
   cp /cad/.cdsinit /home/學號

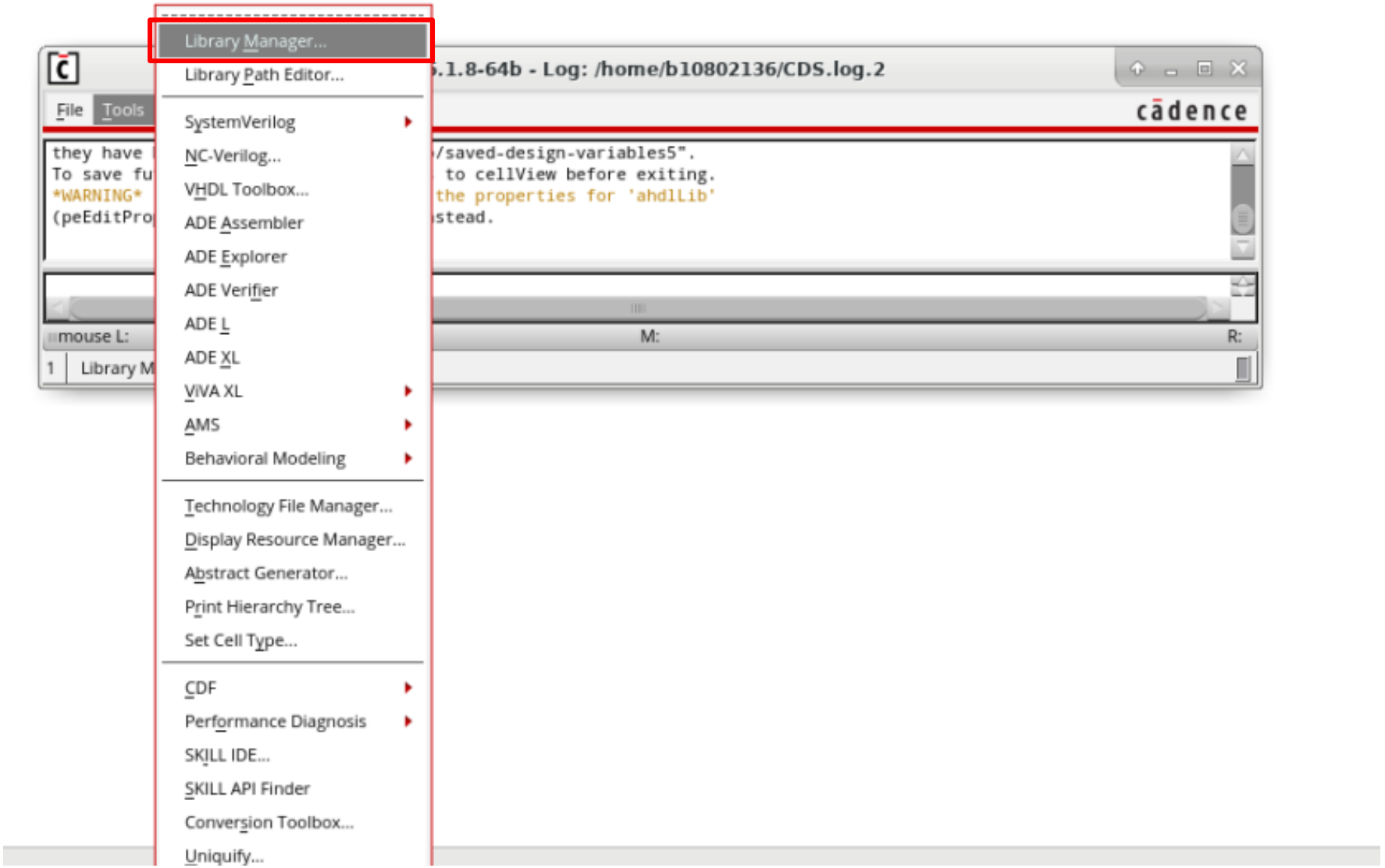


Simulation Environment Settings

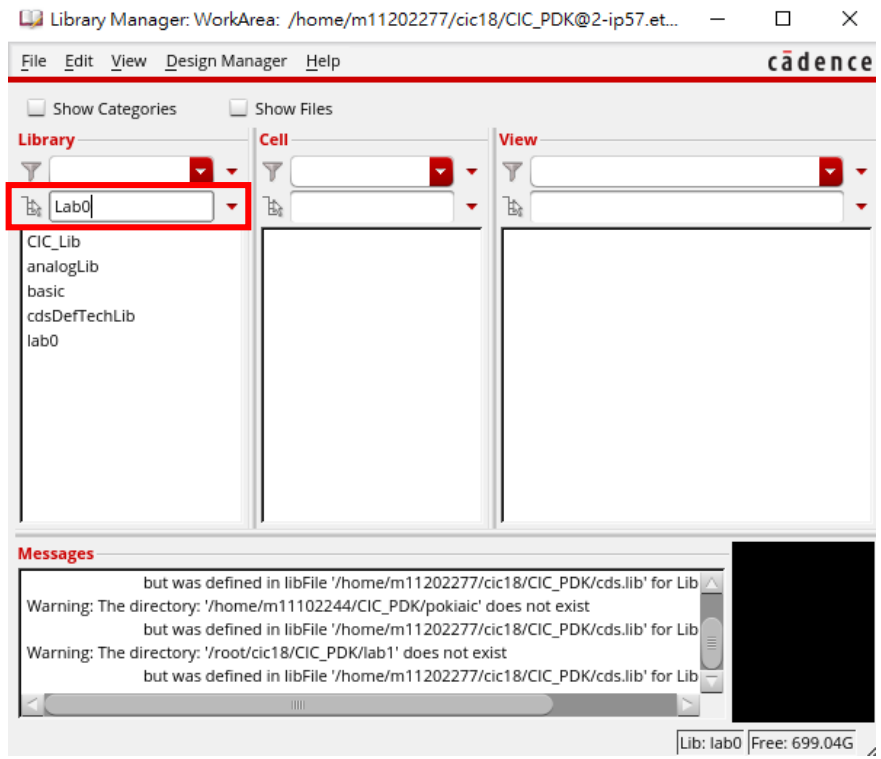
5. 輸入 tcsh
   （僅第一次登入時需要輸入）
6. 照順序輸入以下指令
   cd cic18
   cd CIC_PDK
   （進入CIC_PDK的資料夾中）
7. virtuoso &（打開virtuoso）

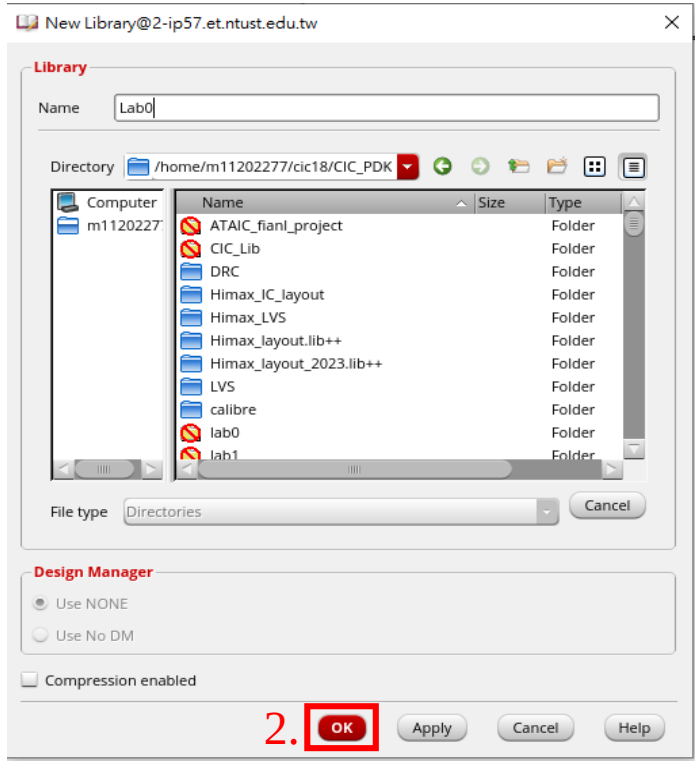


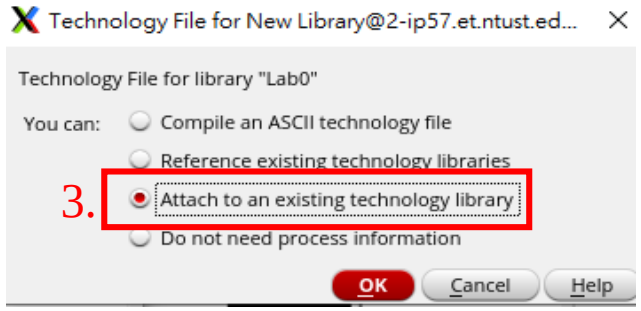
Open Virtuoso

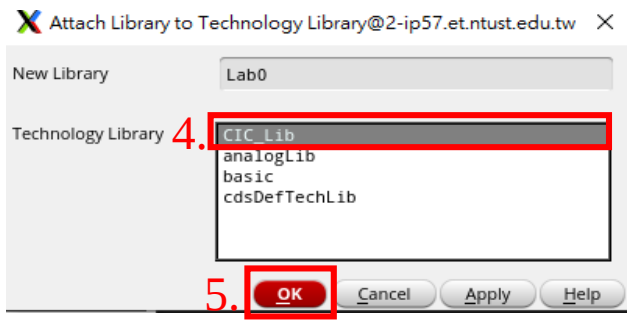


Create Library

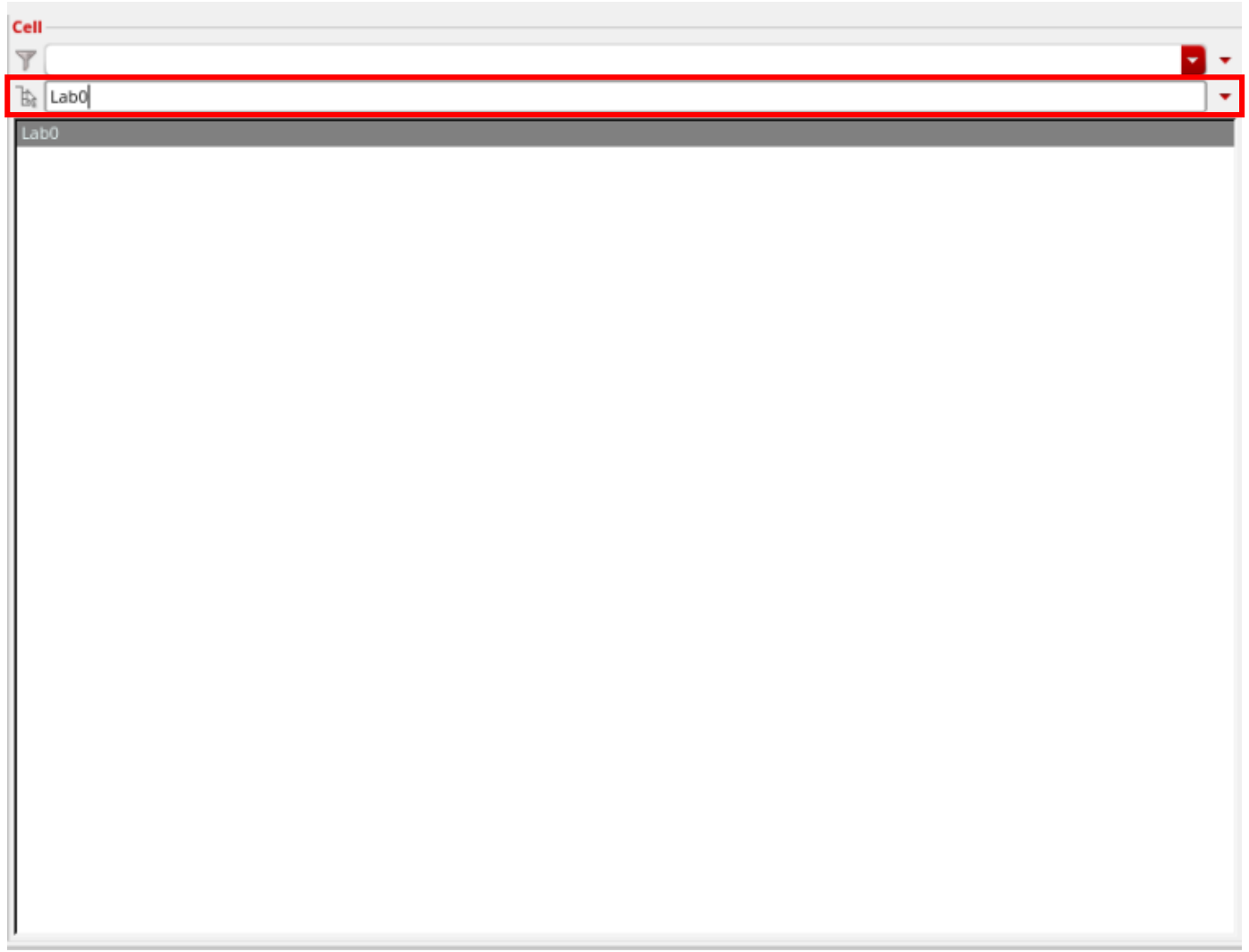


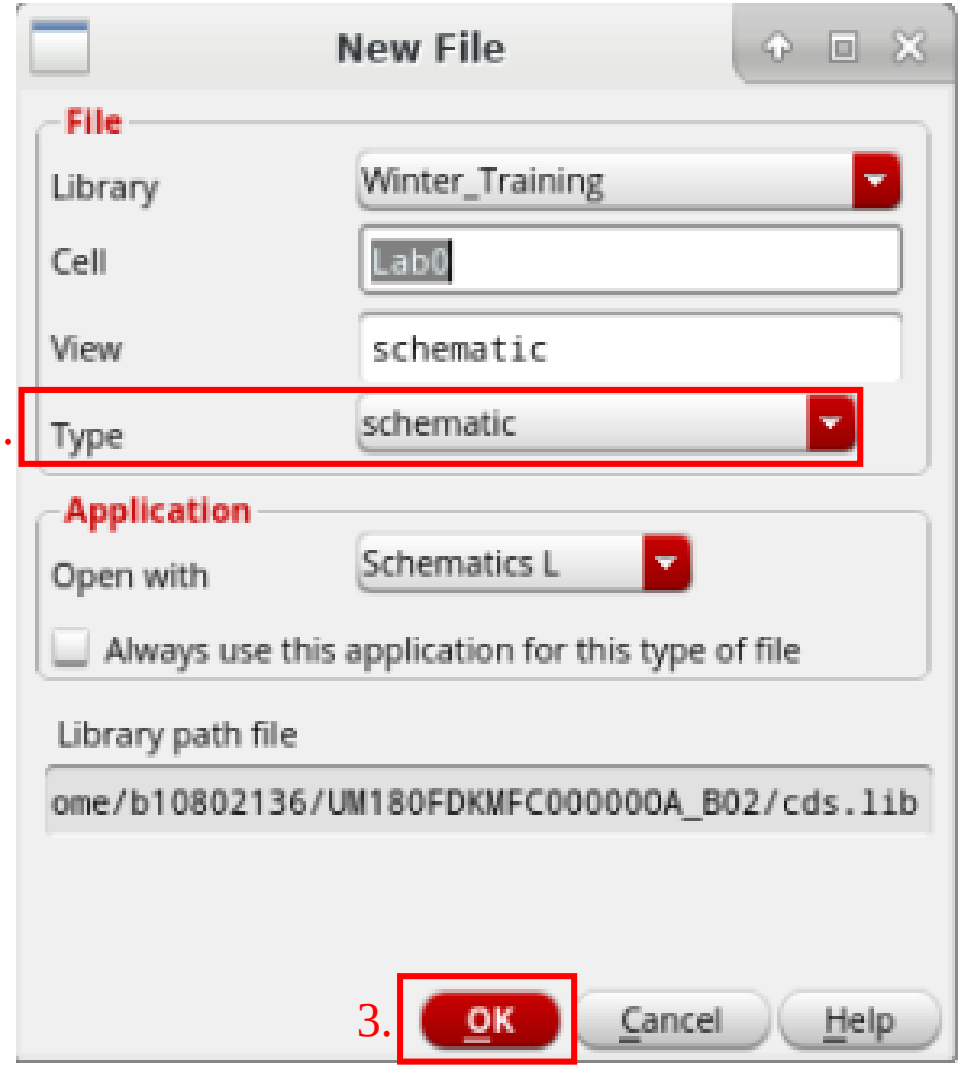




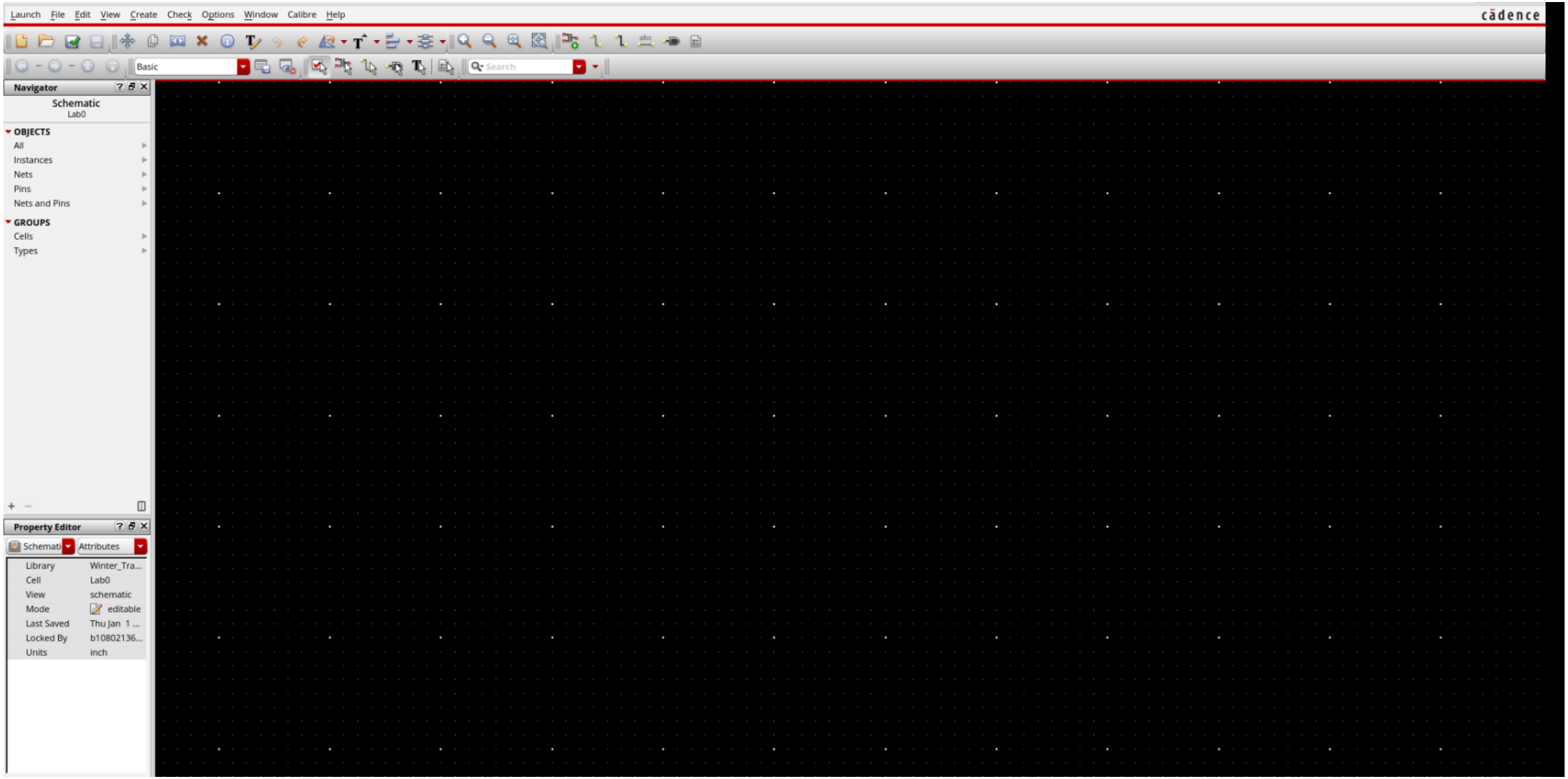


Create Schematic





Schematic Editor

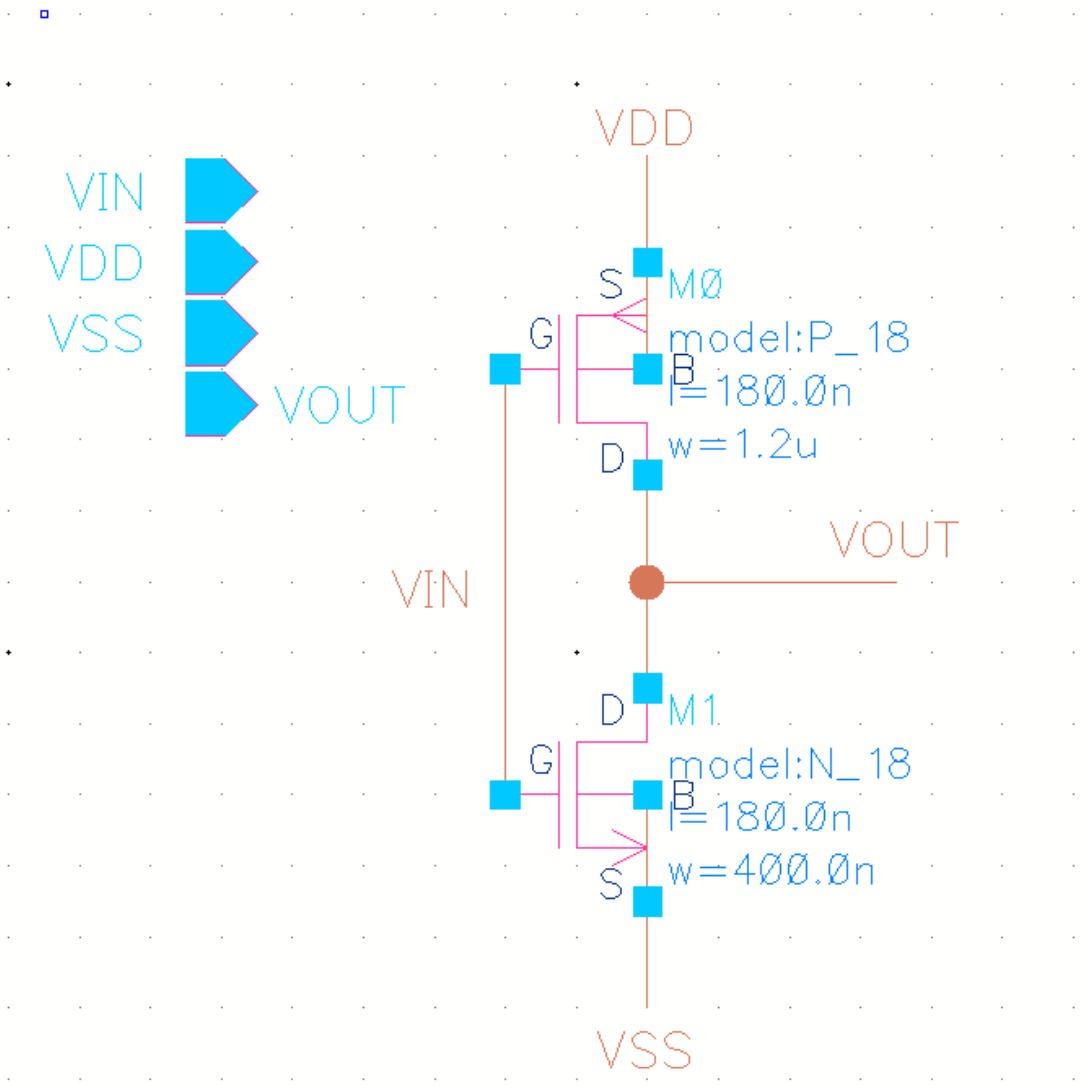


Hotkey

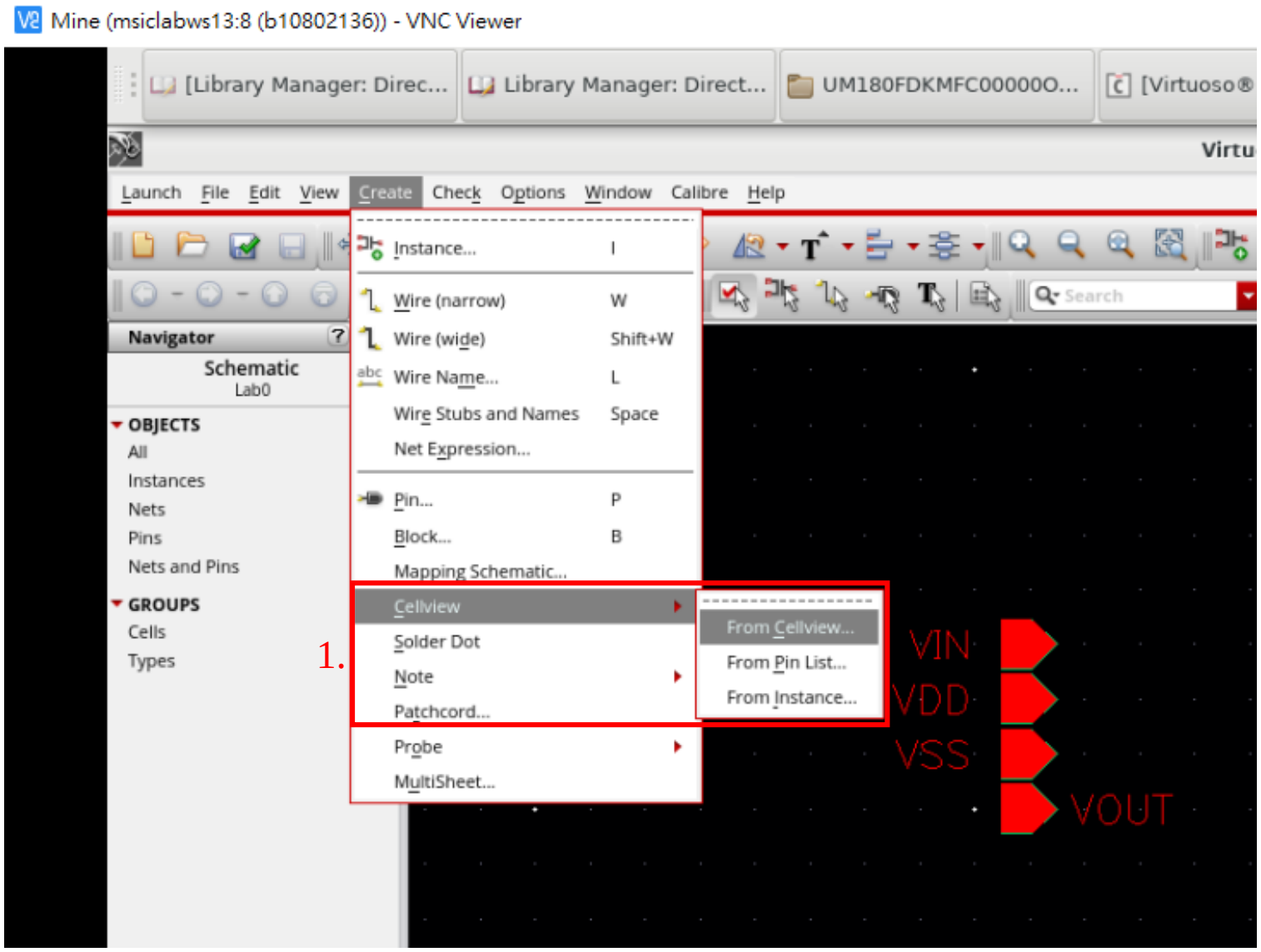
Virtuoso 有大小寫之分，這裡都是小寫!!

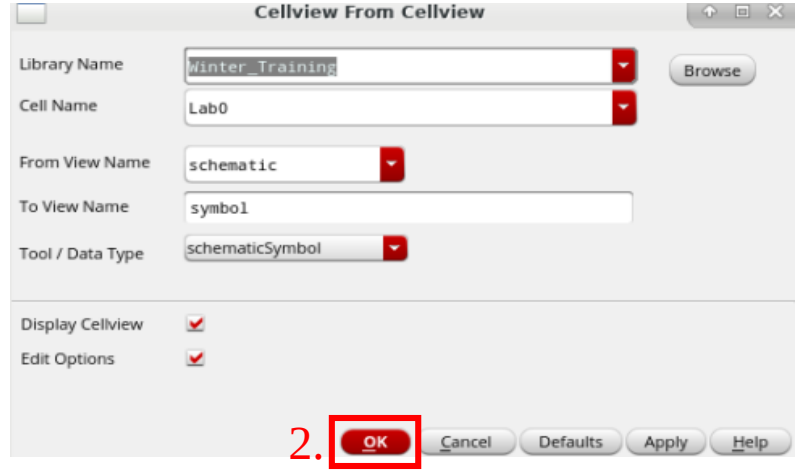
- i : 呼叫元件
  (Ex:CIC_Lib→N_18/P_18/N_33/P_33/….analogLib→res/cap/vdc/vpulse/vpwl/vsin/idc…..)
- w : 畫線(+F3可以改一些設定)
- m : 移動元件
- q : 更改已放置的元件設定
- c : 複製元件
- l : 在Wire打上Label
- p : 設置PIN腳
- f : 畫面置中
- r : 旋轉元件(可以配合Ctrl/Shift/按滑鼠滾輪/+F3)
- u : 上一步

Inverter

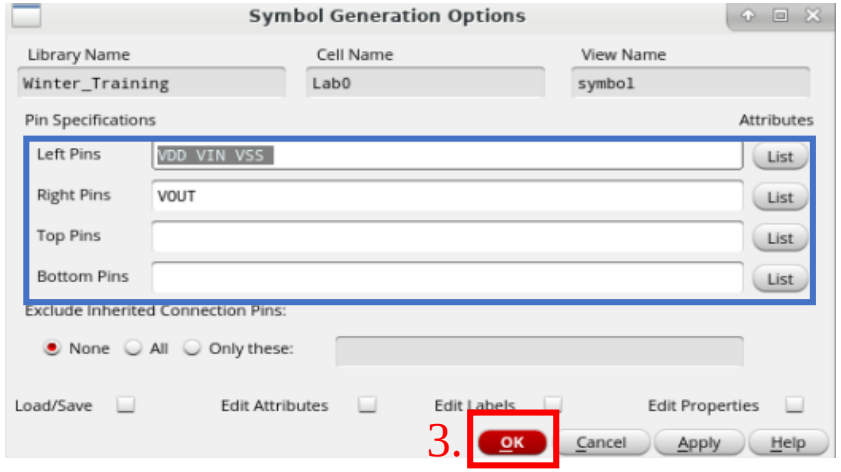

VIN
VDD
VSS
VOUT
VDD
S
M0
G
model:P_18
B
l=180.0n
w=1.2u
D
VOUT
VIN
D
M1
G
model:N_18
B
l=180.0n
w=400.0n
S
VSS

Create Symbol Cell

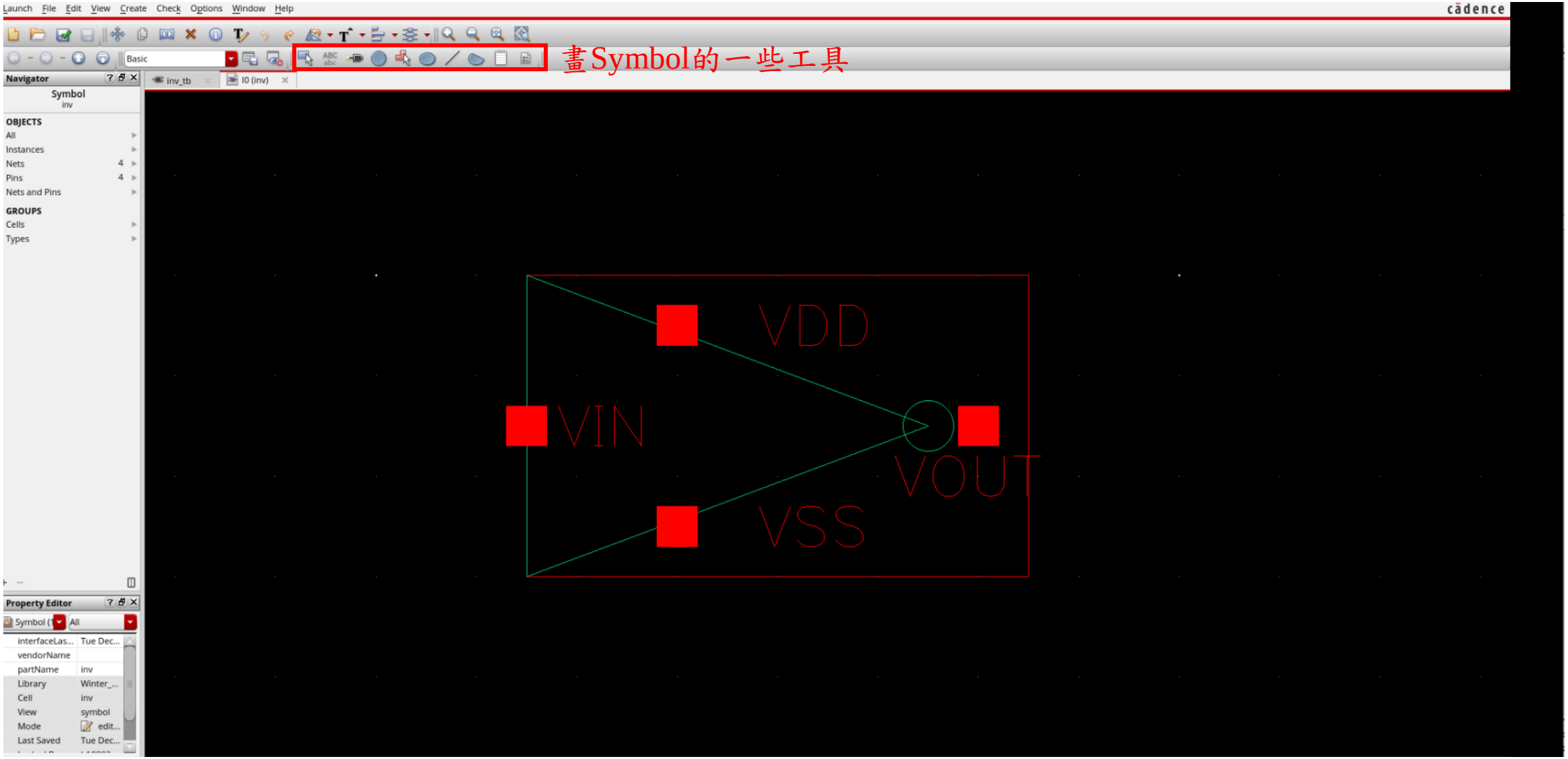




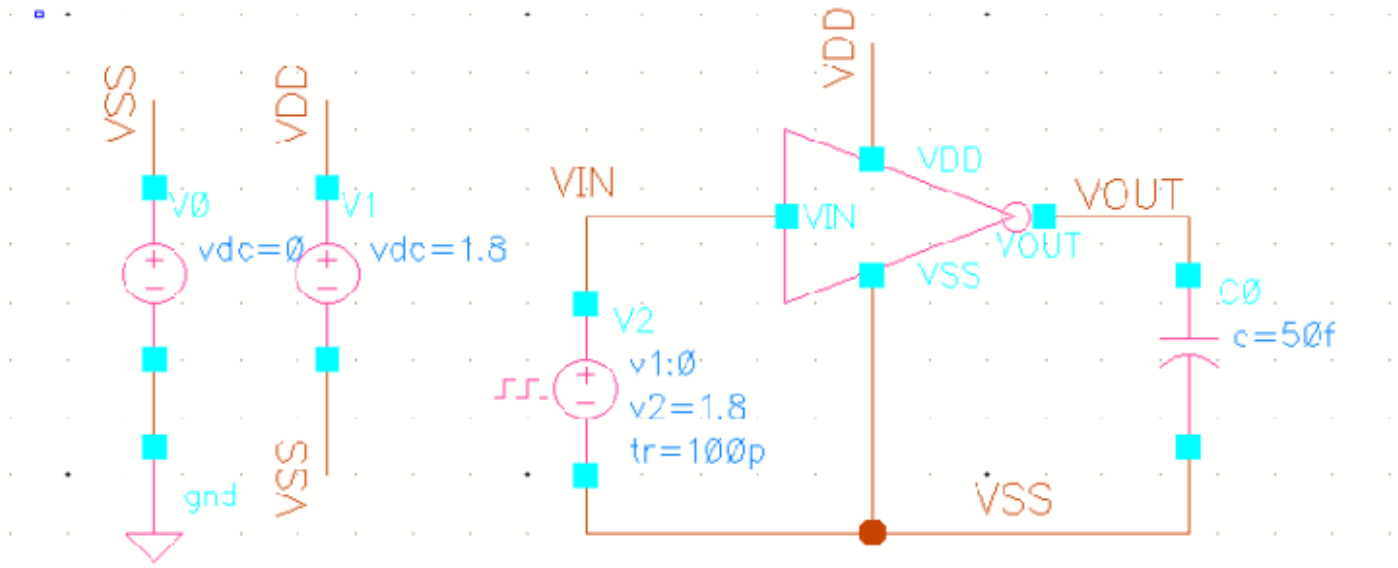
可以調整PIN腳的預設方向

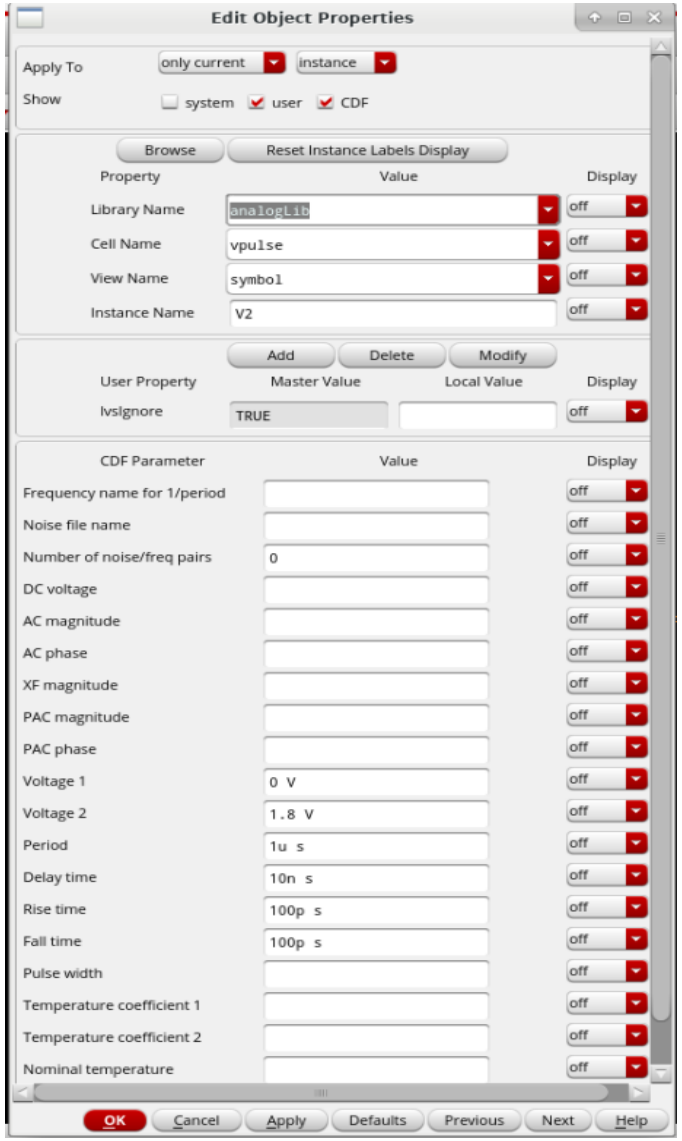


Create Symbol Cell

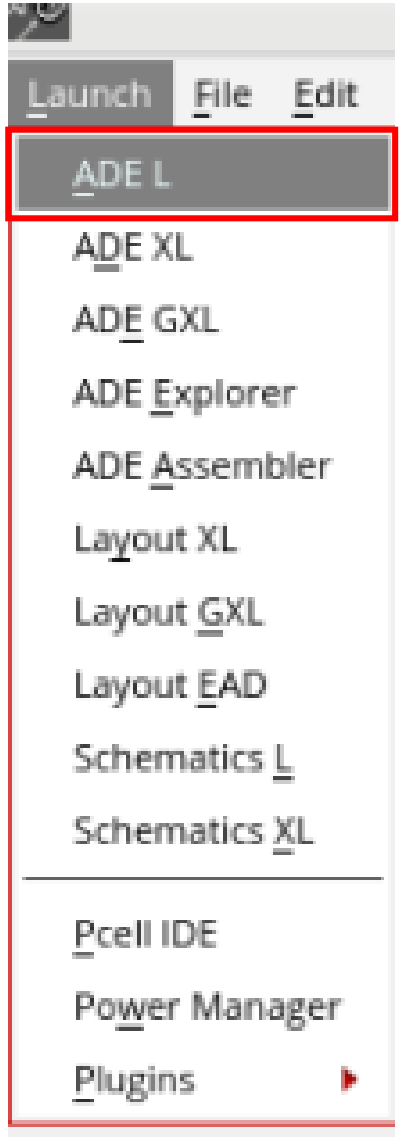


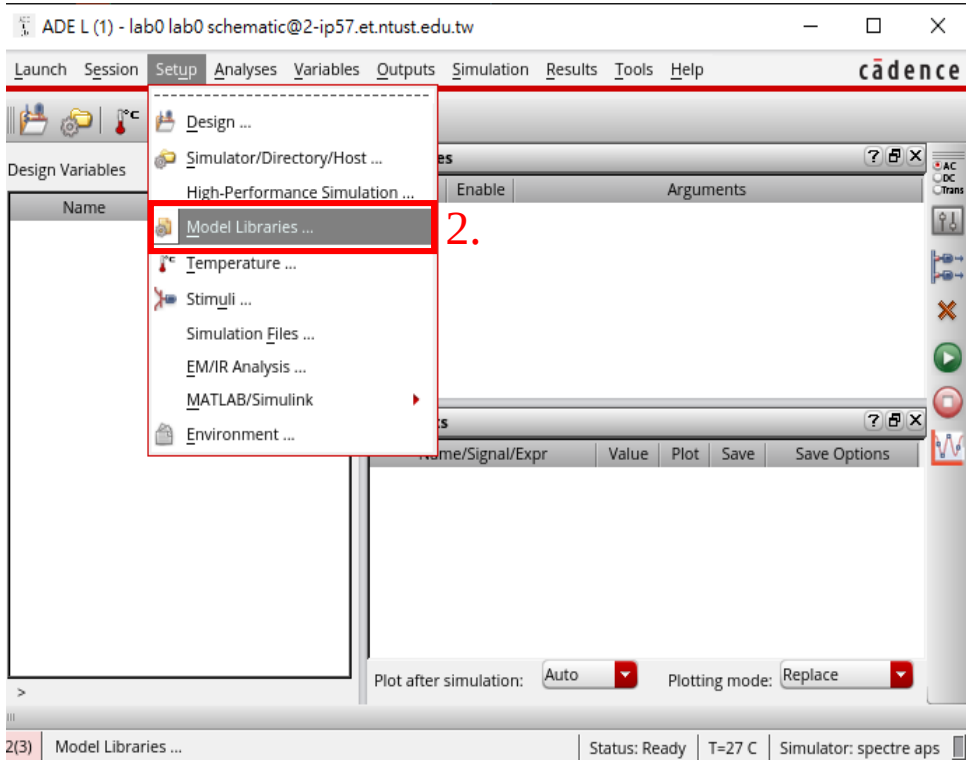
Inverter Testbench

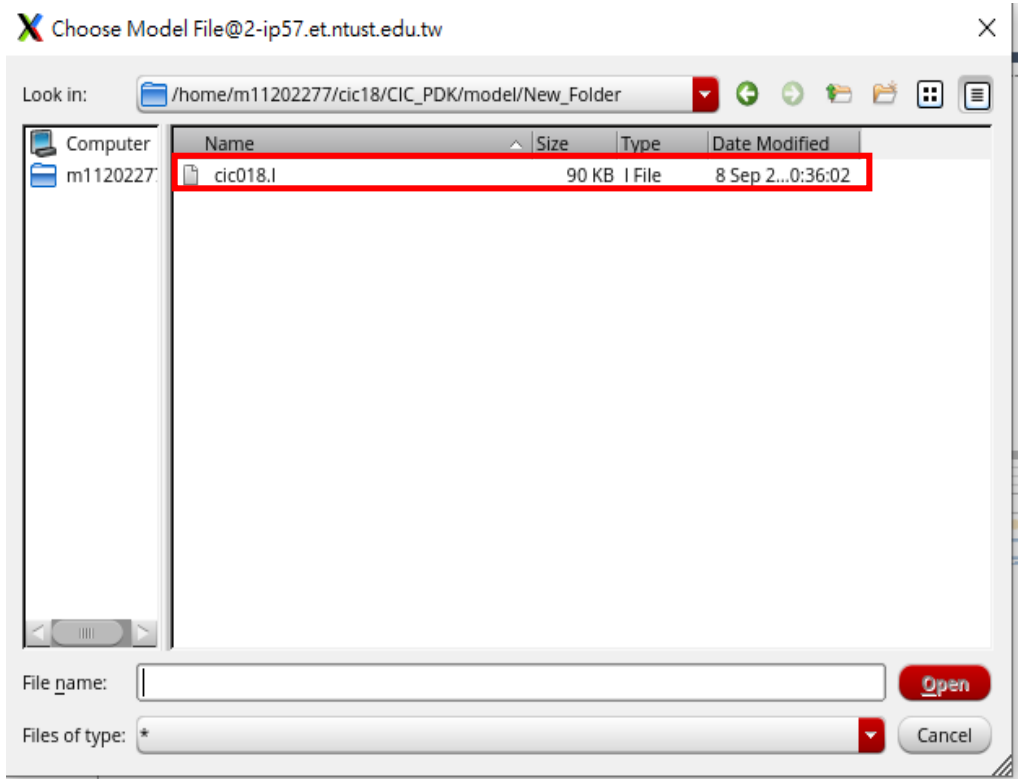




Model Settings

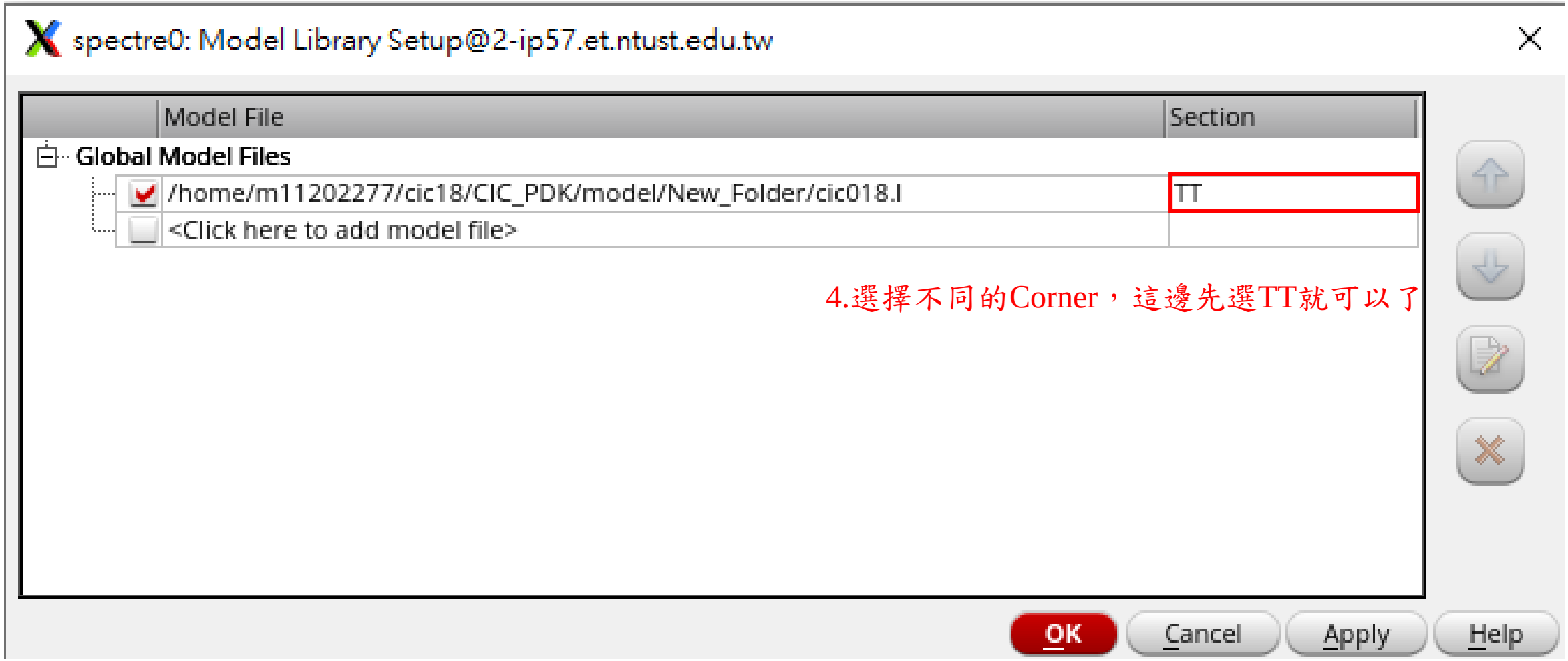




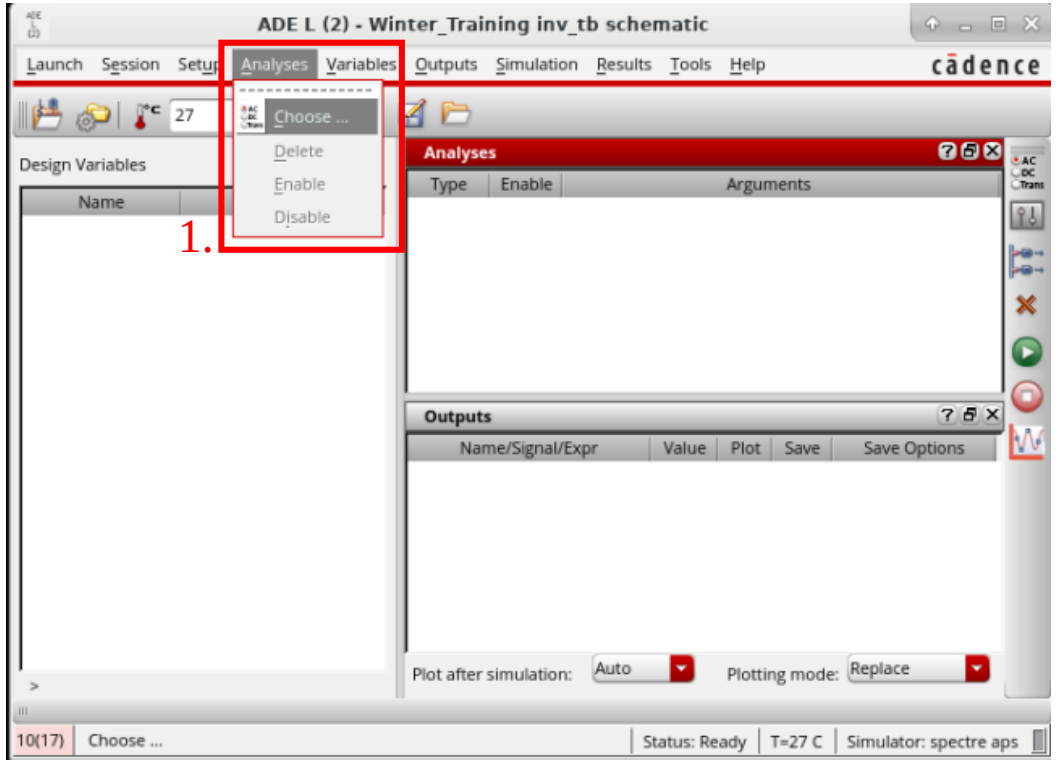


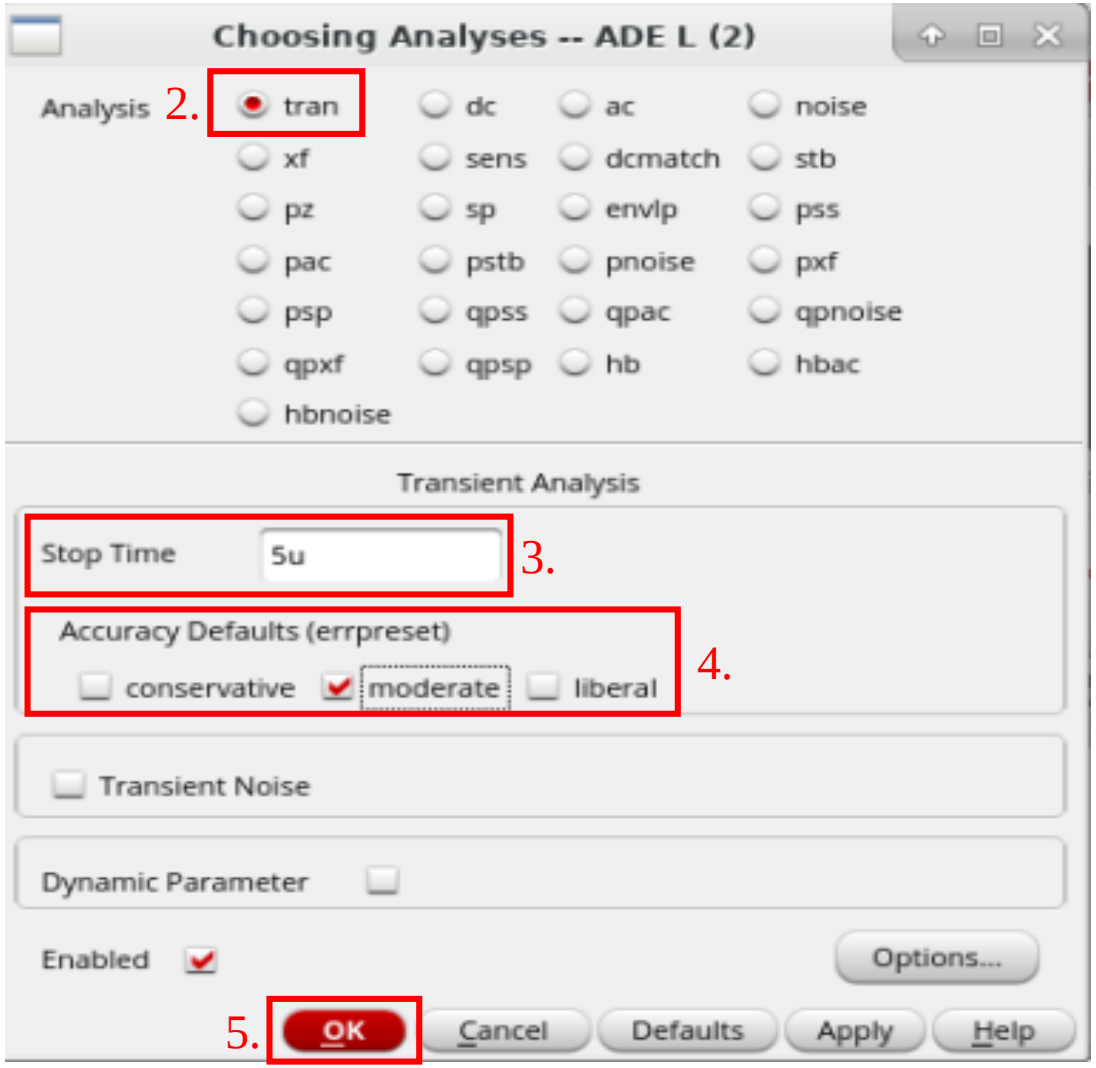
3.選擇cic018.l這個檔案
（路徑：/home/學號/cic18/CIC_PDK/model/New_Folder）

Model Settings



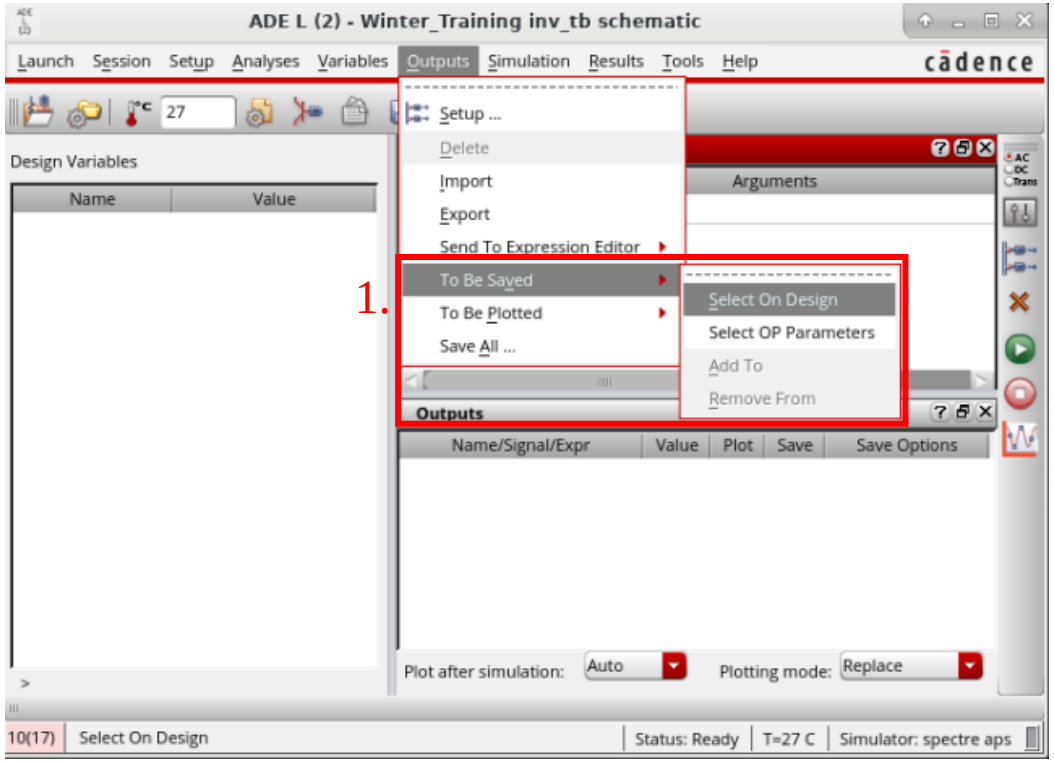
Transient Analysis



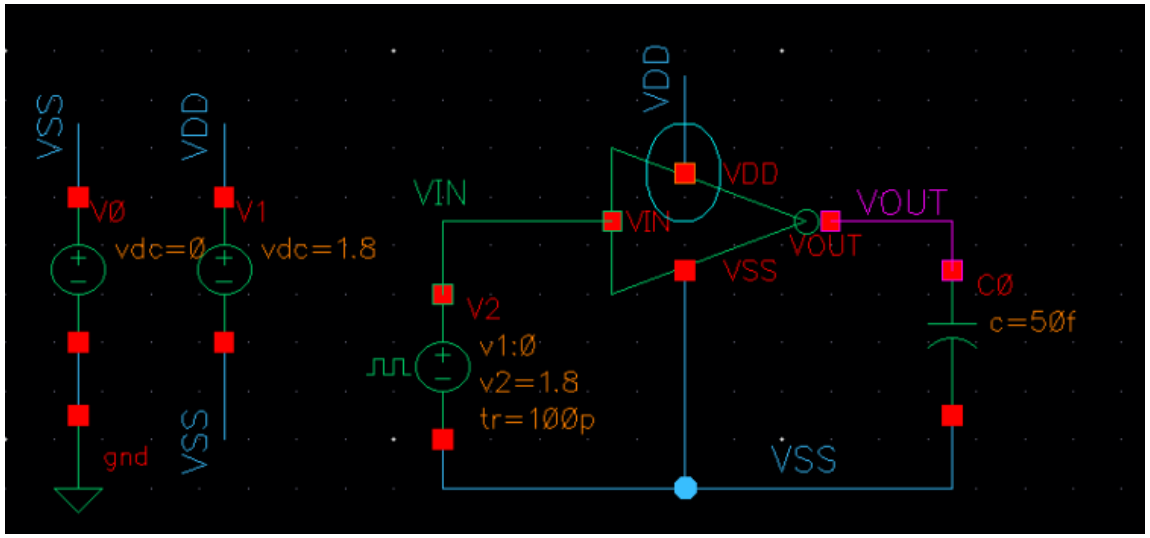


※設定.tran的精確度
(conservative > moderate >liberal)
一般來說設定moderate即可但有時候看電流波型，
可能會需要較高的精度，就可以使用conservative!!

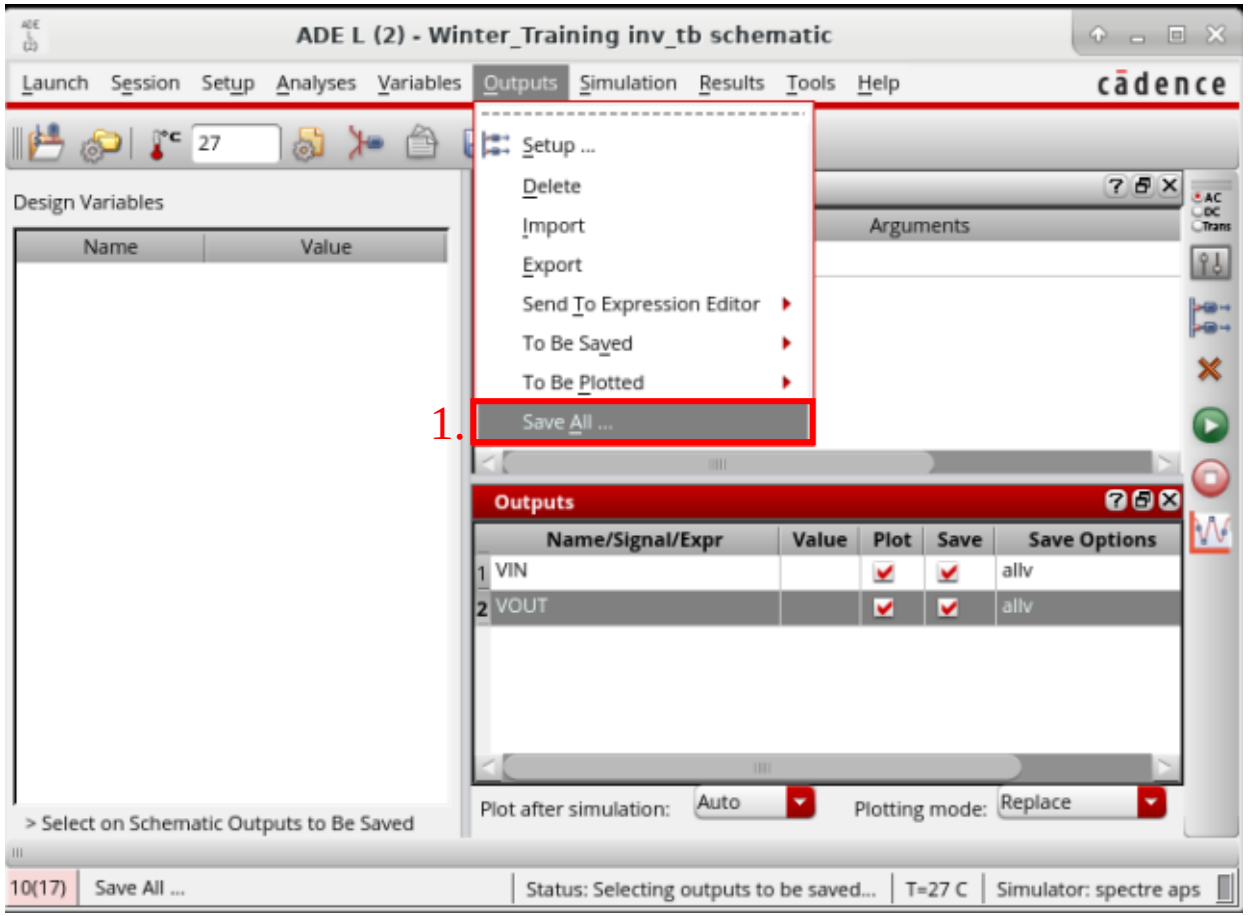
Transient Analysis



※之後對Wire或Label 按滑鼠左鍵，即可儲存該節點電壓
注意如果要看電流的話，要按的是紅色方塊!!



Transient Analysis



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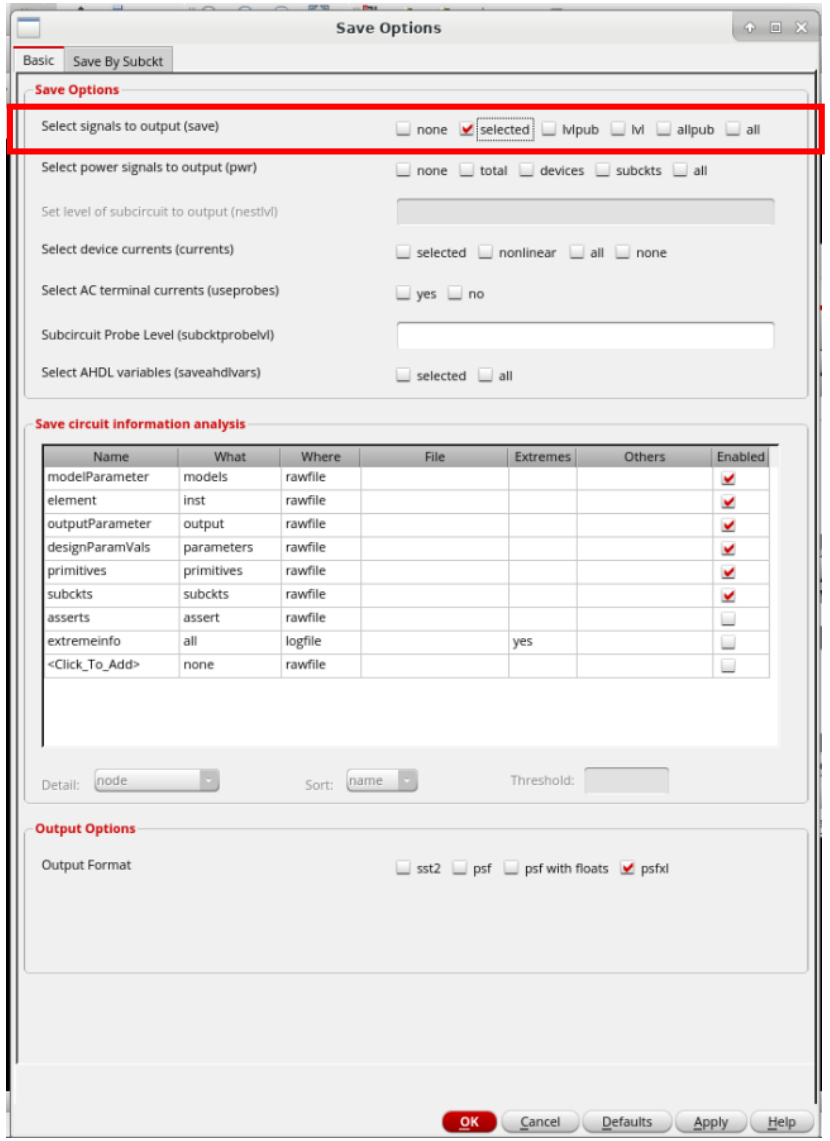
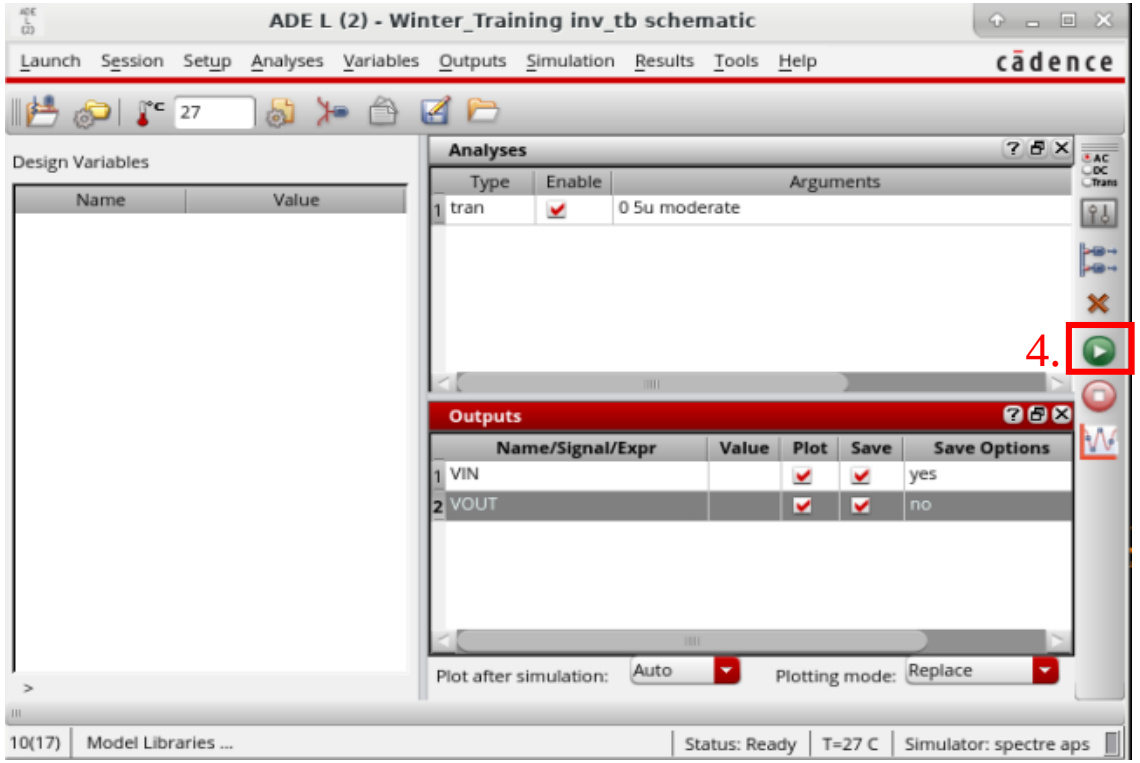


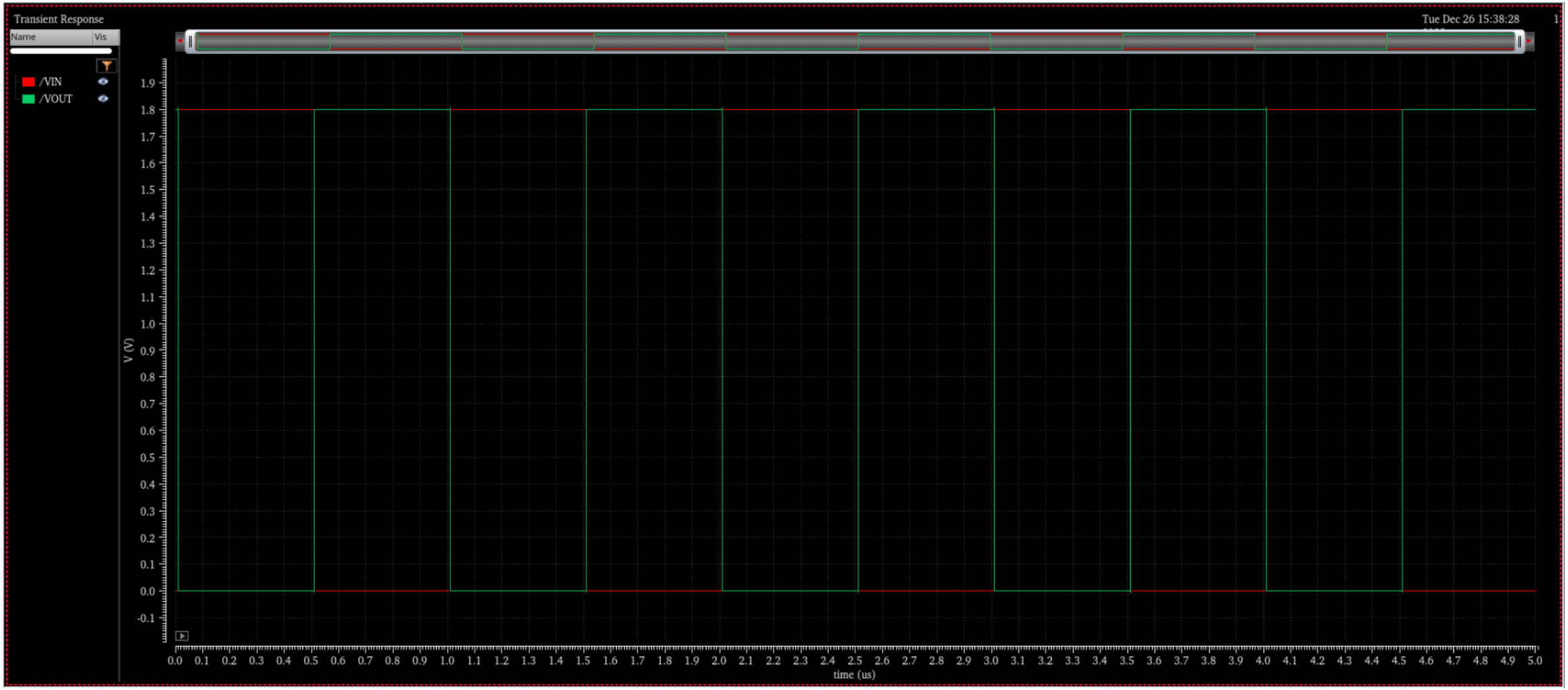
*一定要記得選selected!!不然它會儲存所有的節點
在跑大電路時很容易把硬碟全部吃光!!!!

Transient Analysis

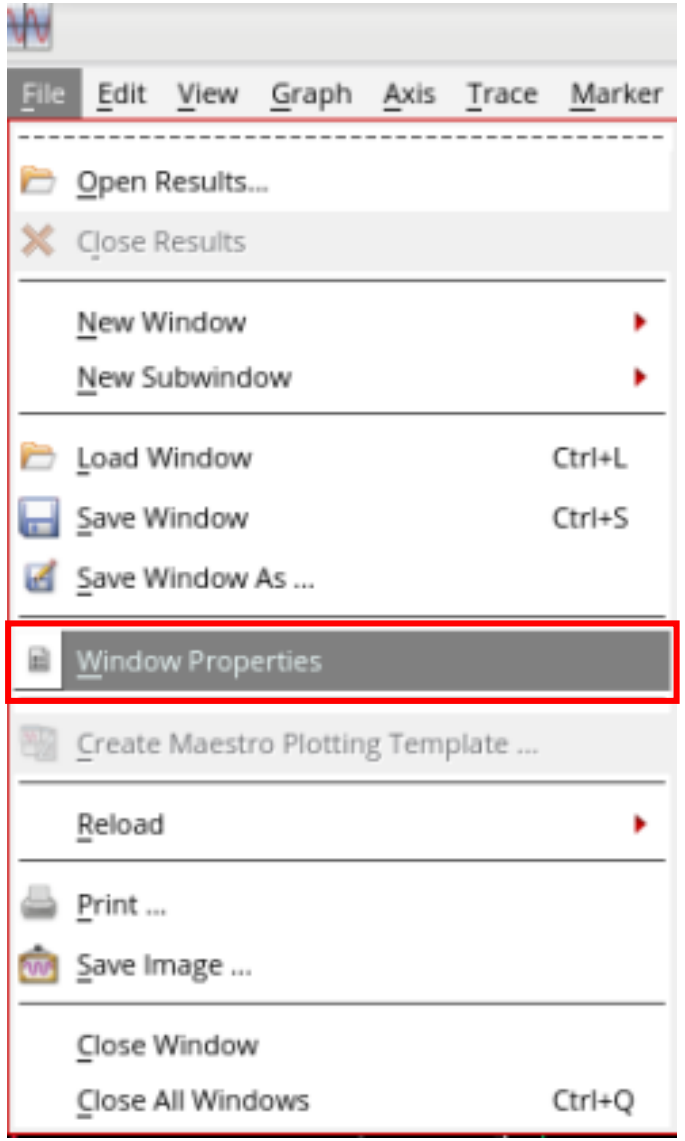
*記得要按save!!不然會無法執行模擬!!



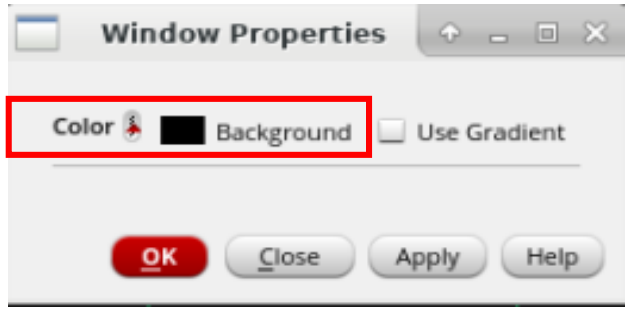
Wave-view Analysis



Wave-view Analysis

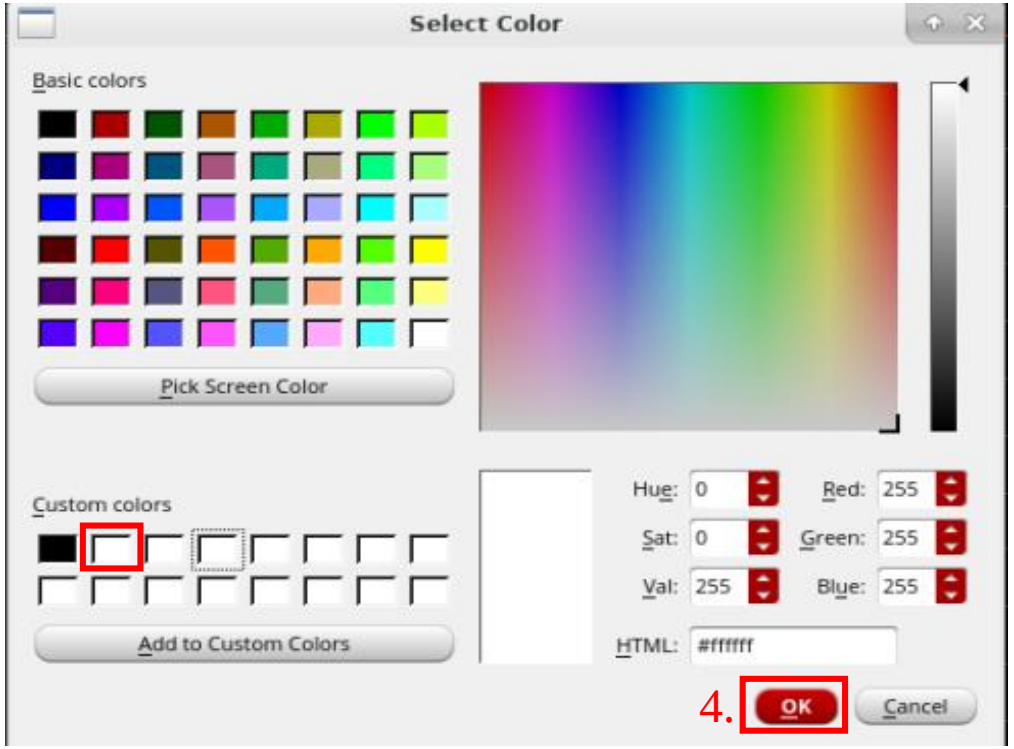


1.



2.

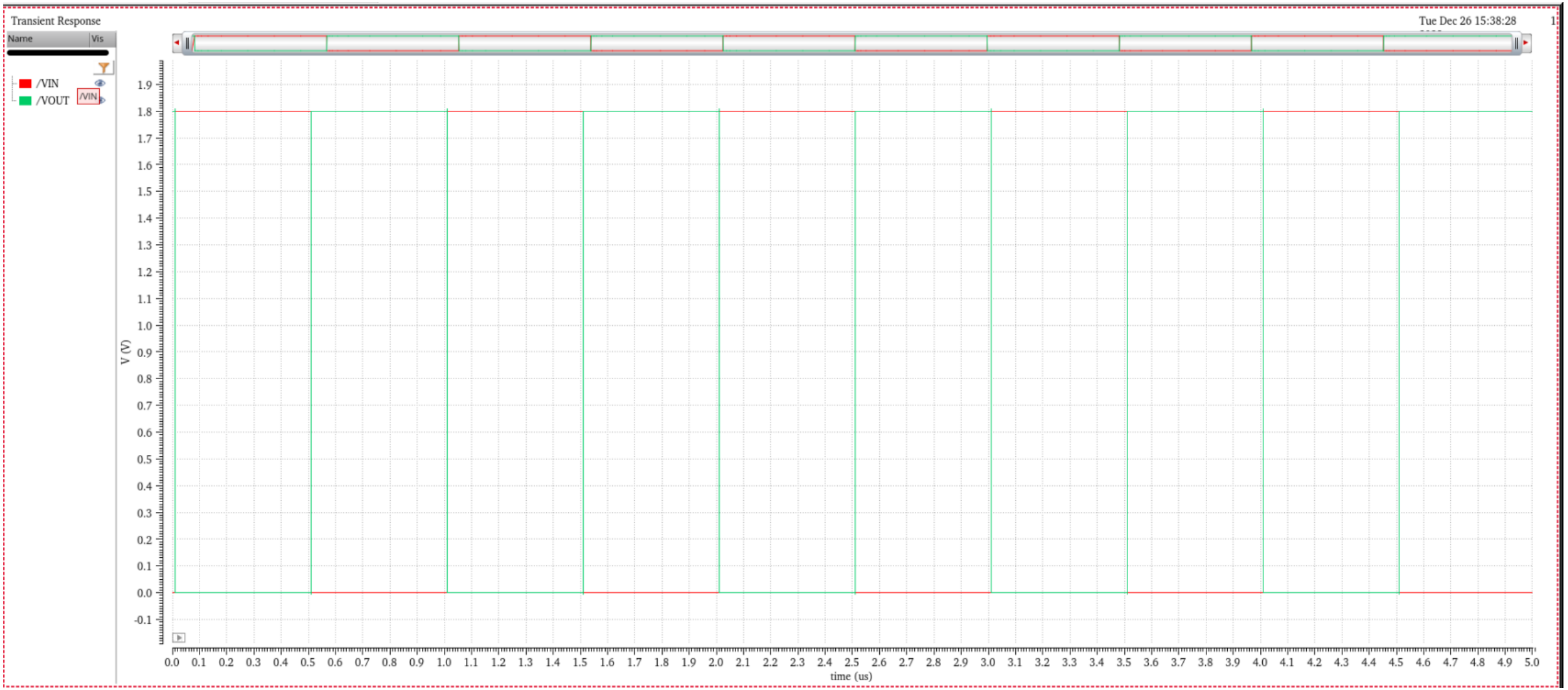
※將背景反白，
在投影幕上呈現
會較為清楚!!



3.

4.

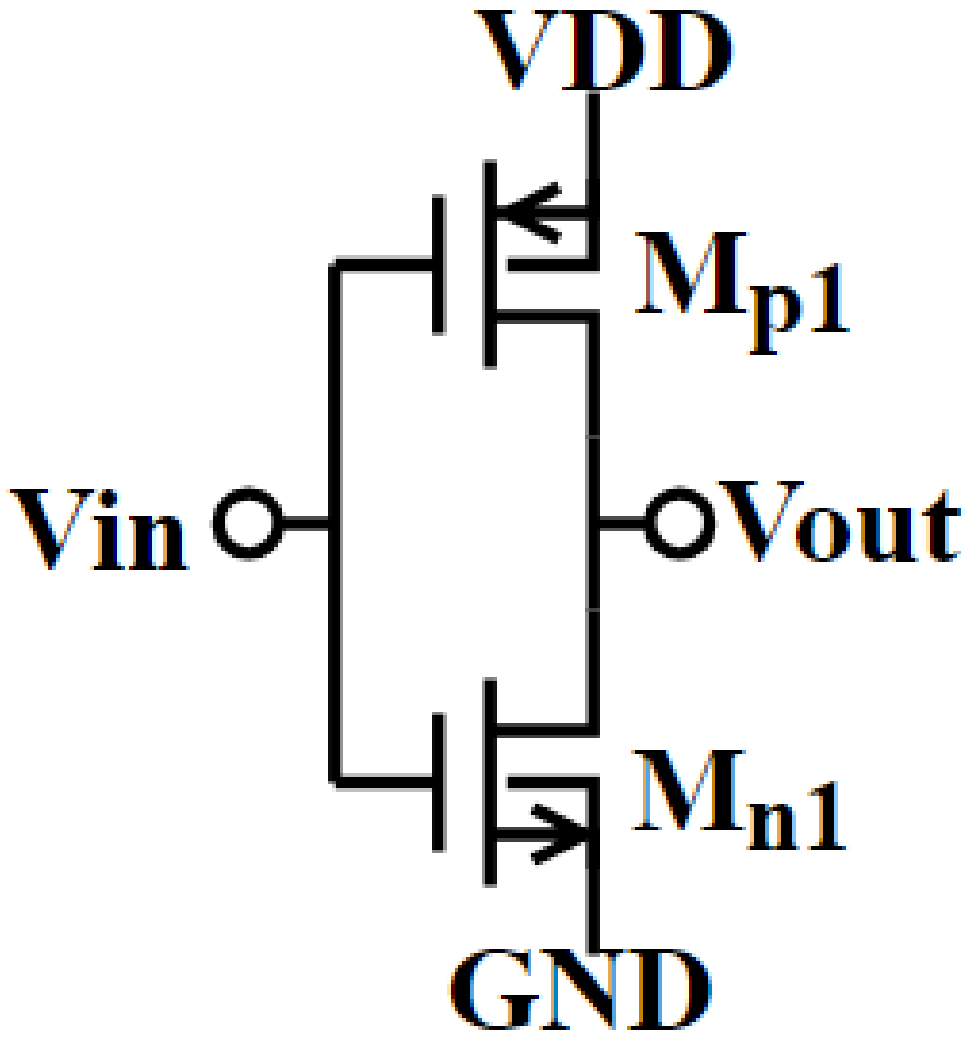
Wave-view Analysis

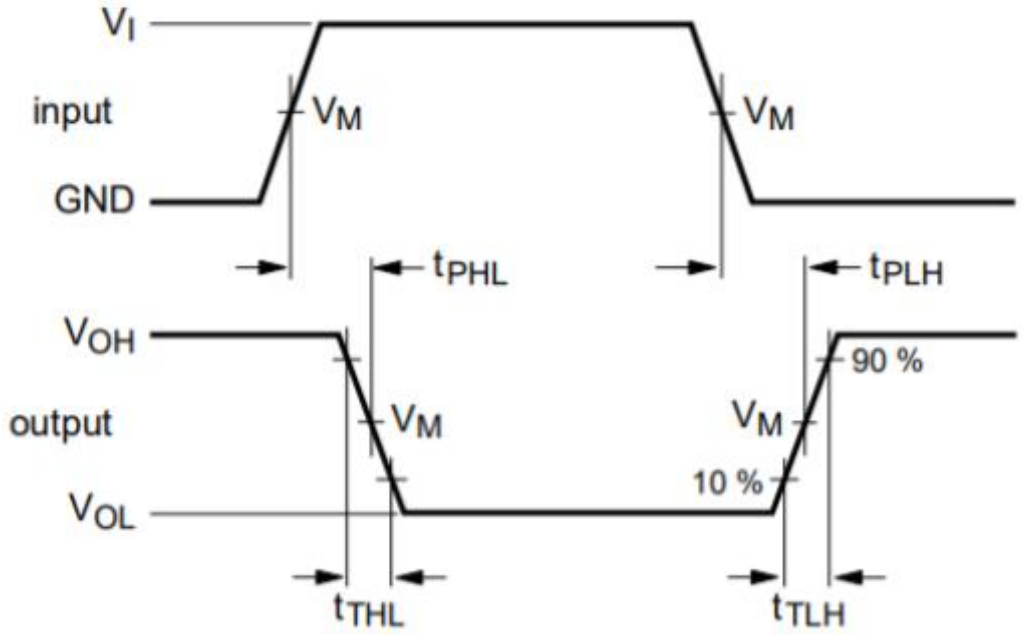


Hotkey

- m : 標記Mark
- d : 任意兩點間的差值
- v : 打一條垂直線
- h : 打一條水平線
- f : 置中

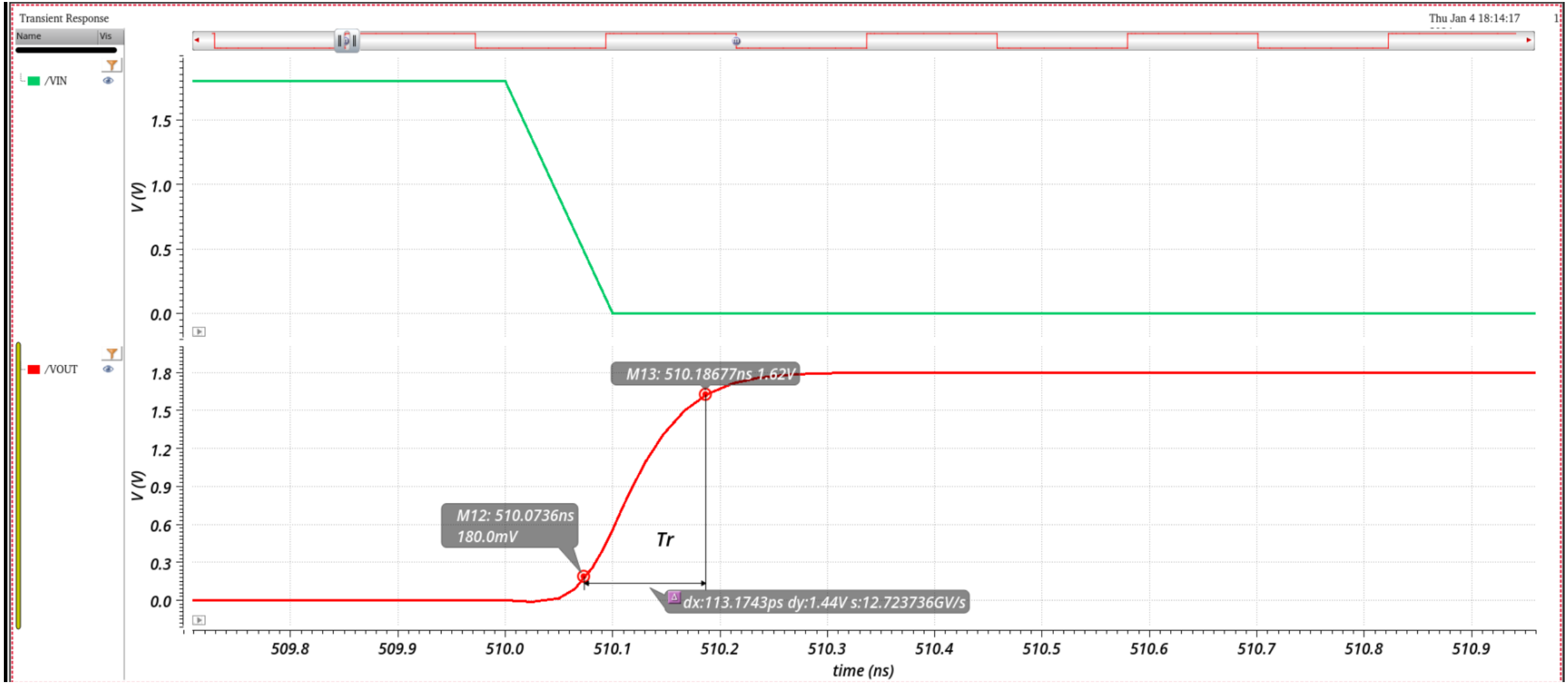
Wave-view Analysis



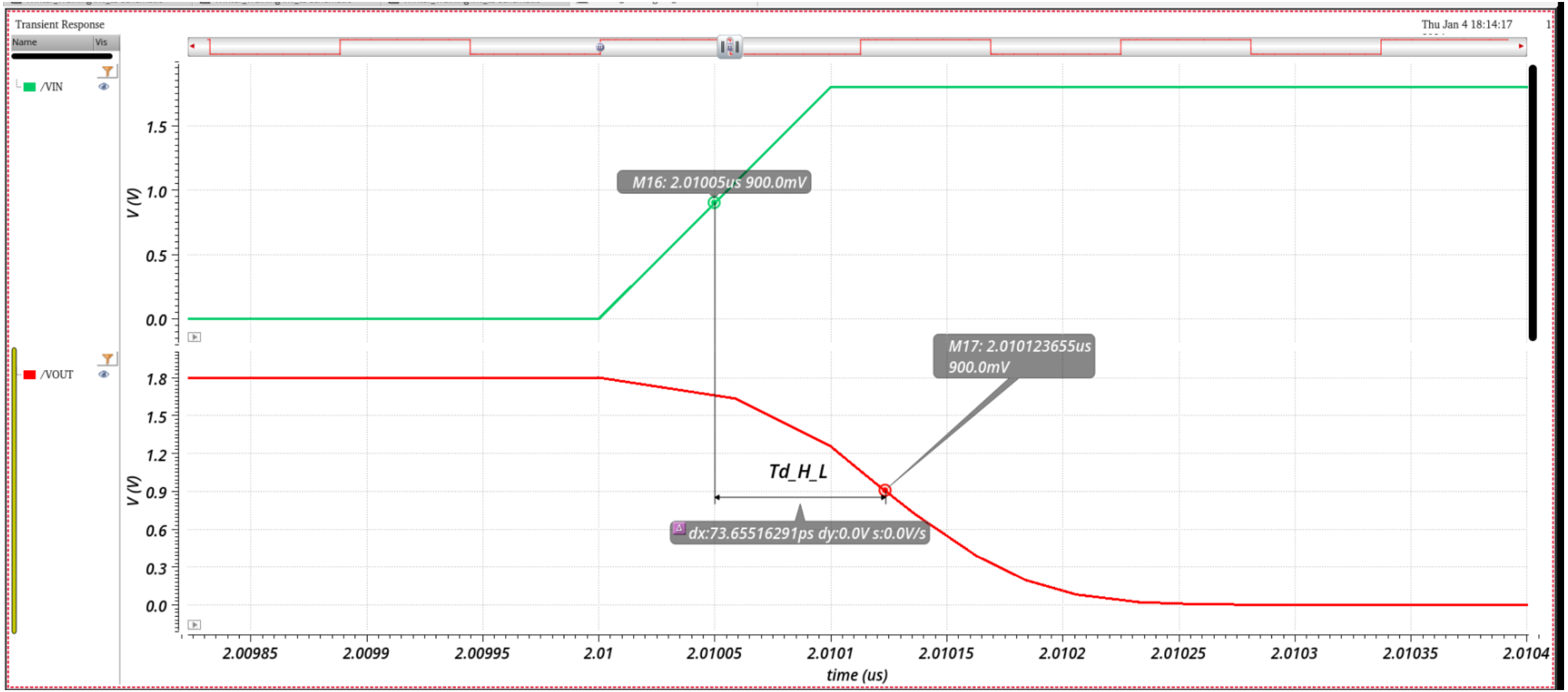


$$V_M = 0.5\,V_{DD}$$

Wave-view Analysis



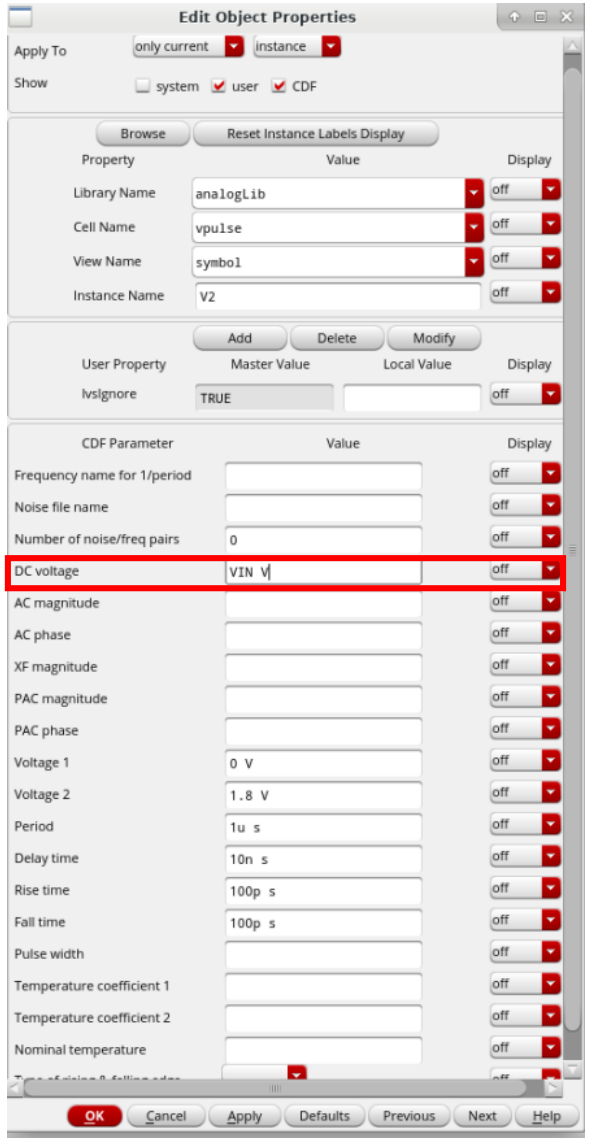
Wave-view Analysis



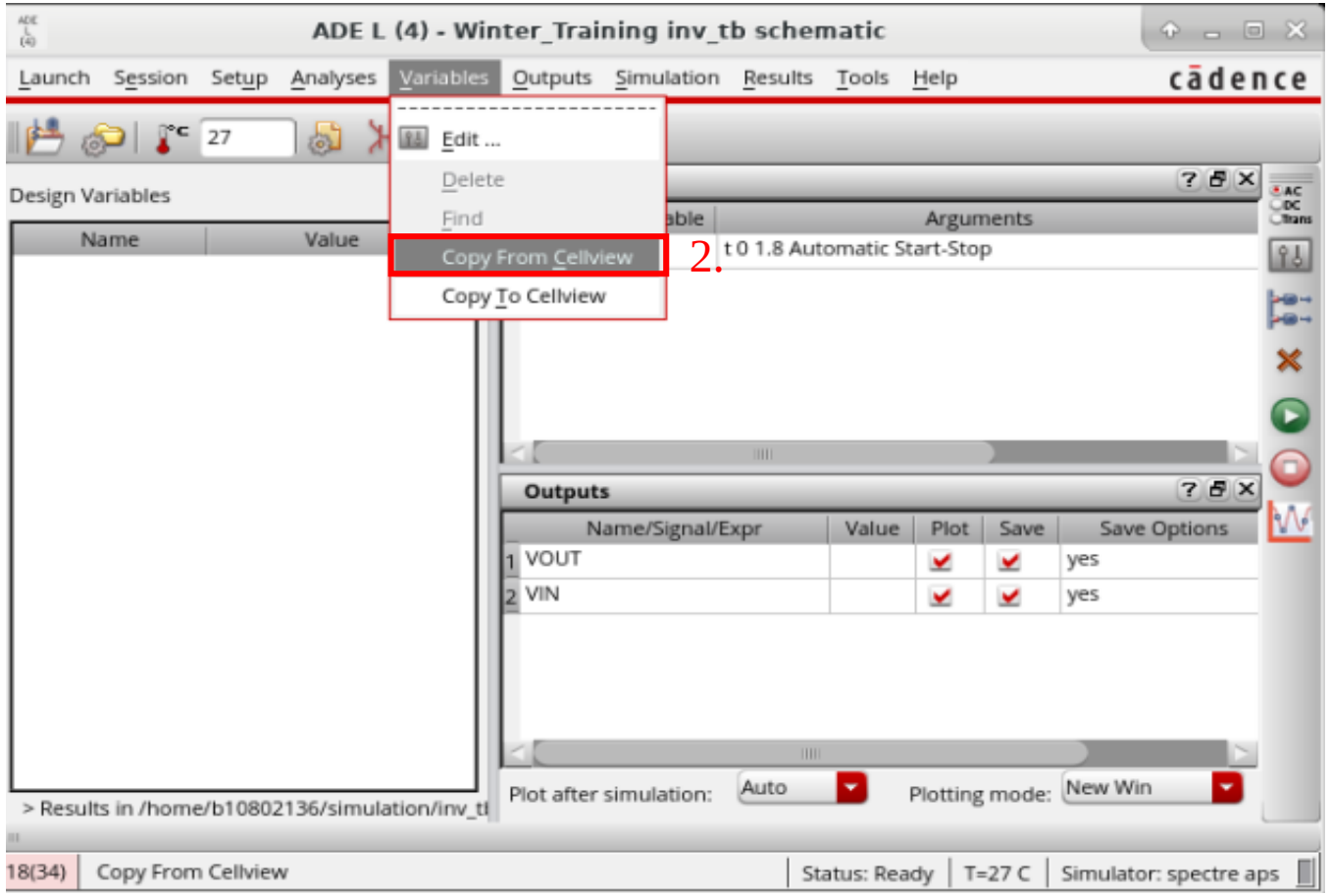
Appendix

- **DC Analysis**
- **AC Analysis**
- **Types of voltage sources**

DC Analysis

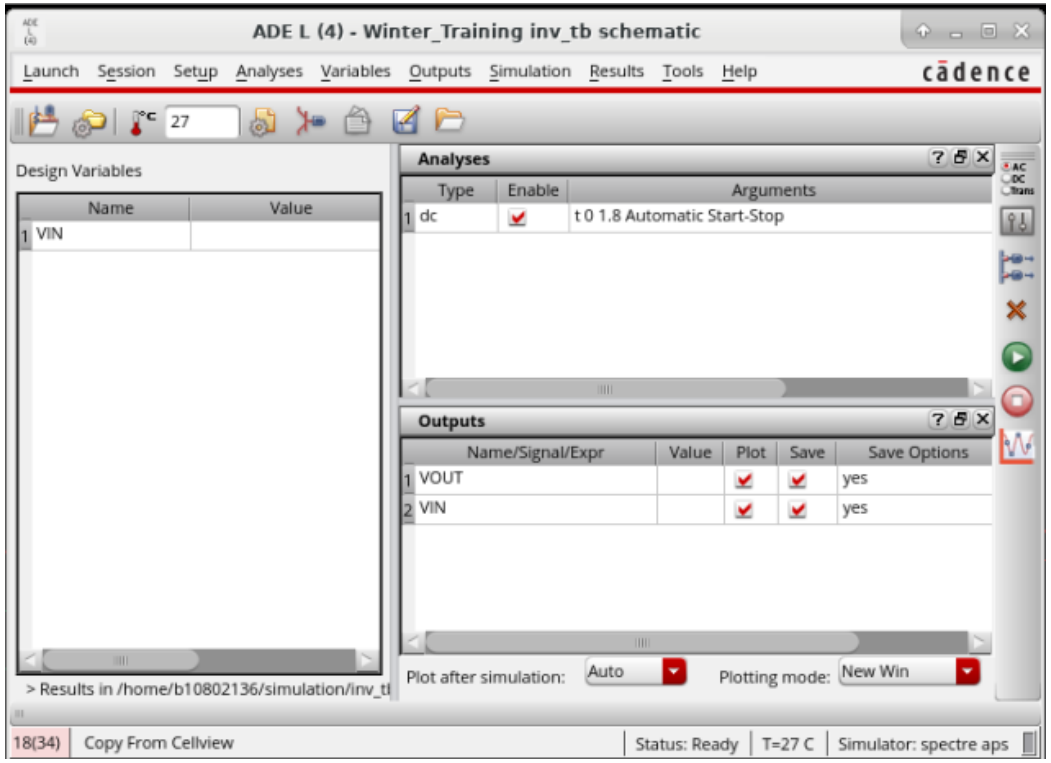


1.

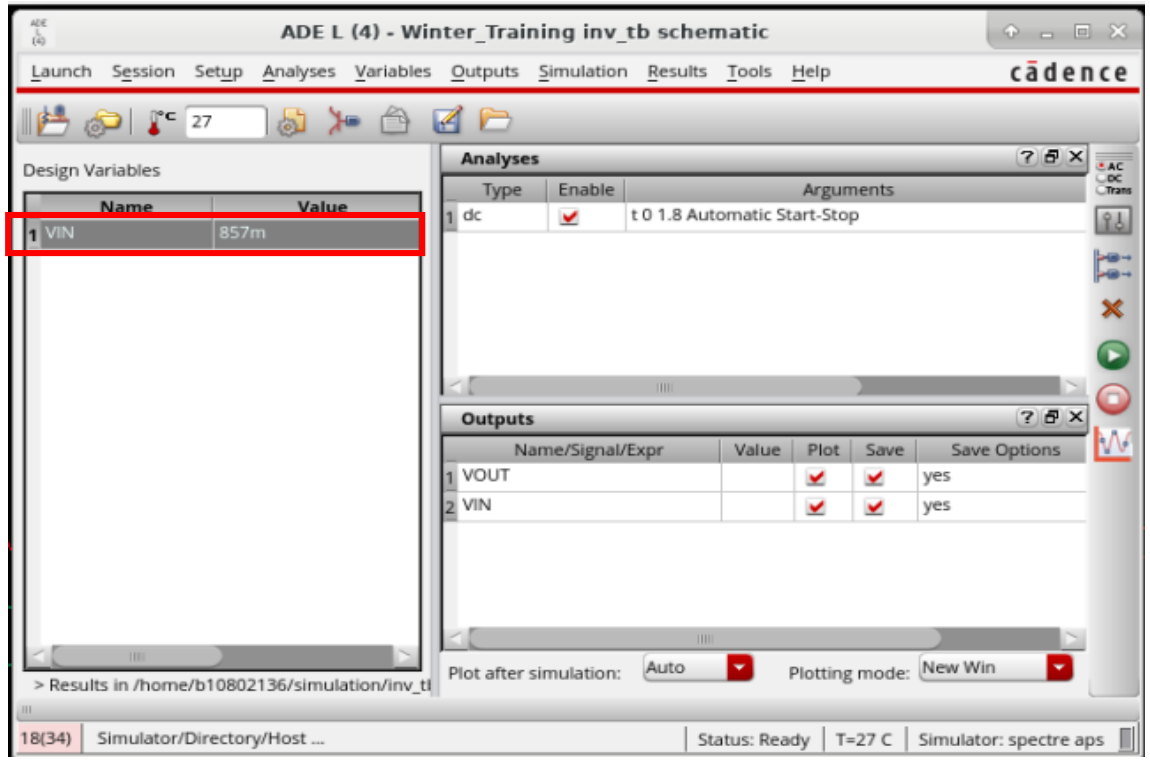


2.

DC Analysis

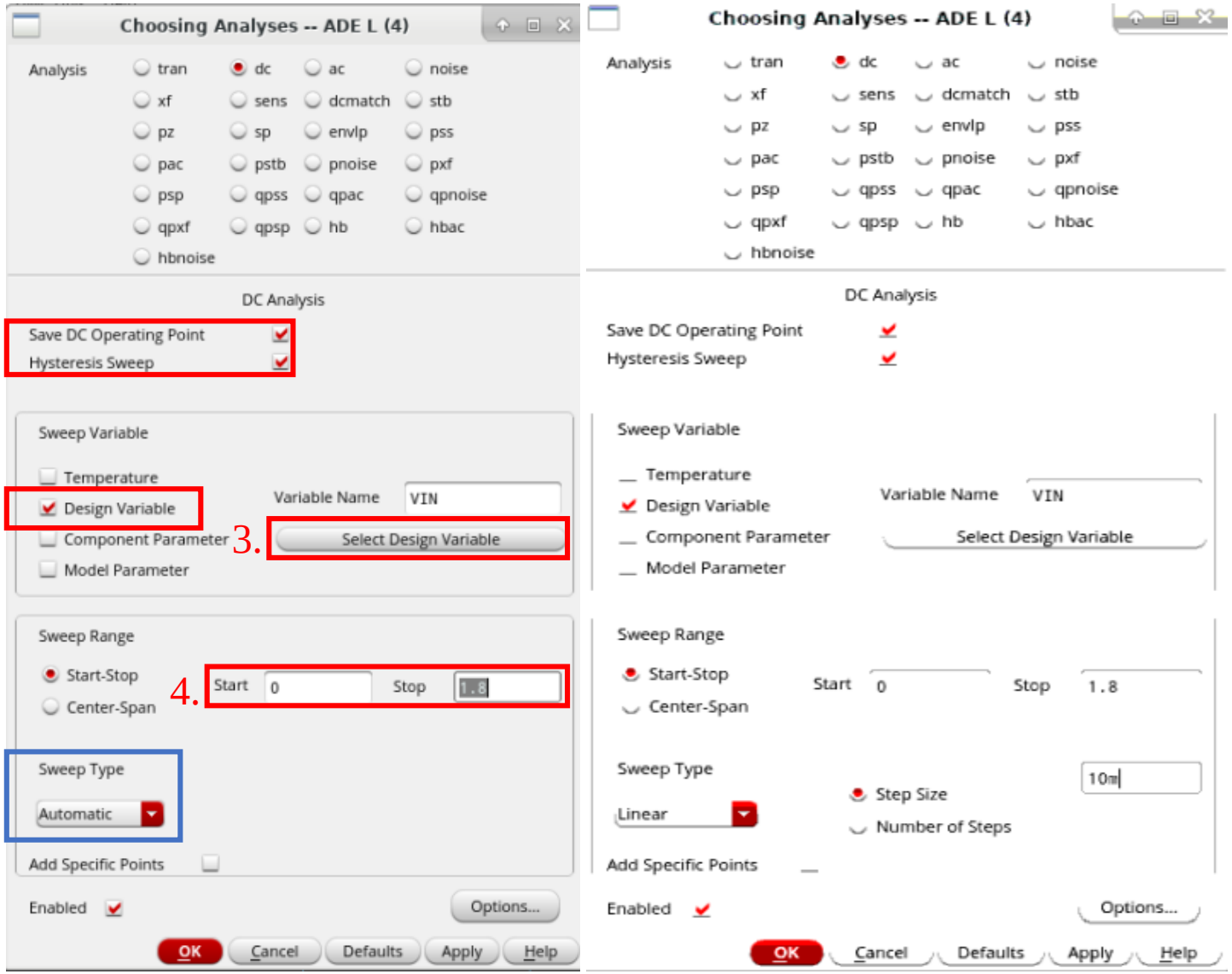


3.



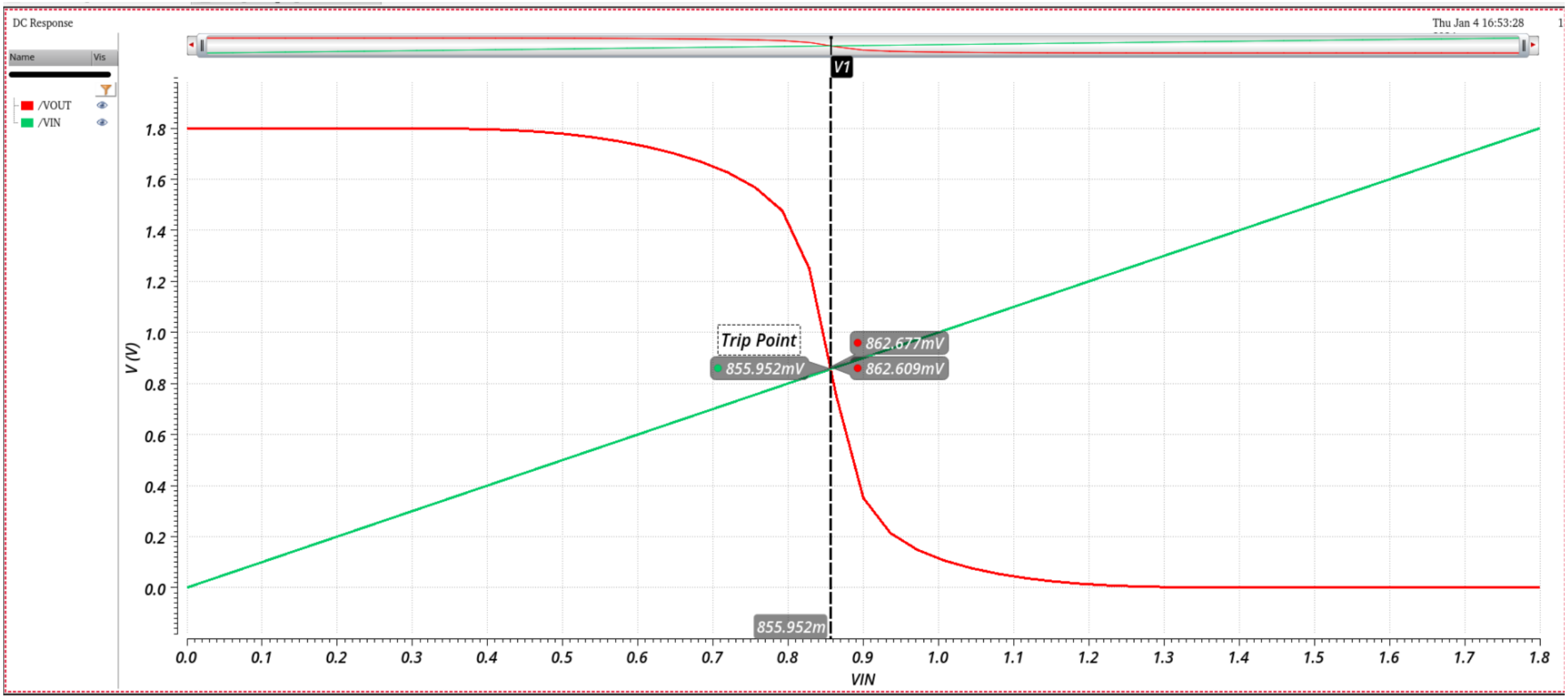
※記得給一個直流操作點，你就可以用operating point看到該直流操作點下，MOSFET的操作情況!!

DC Analysis

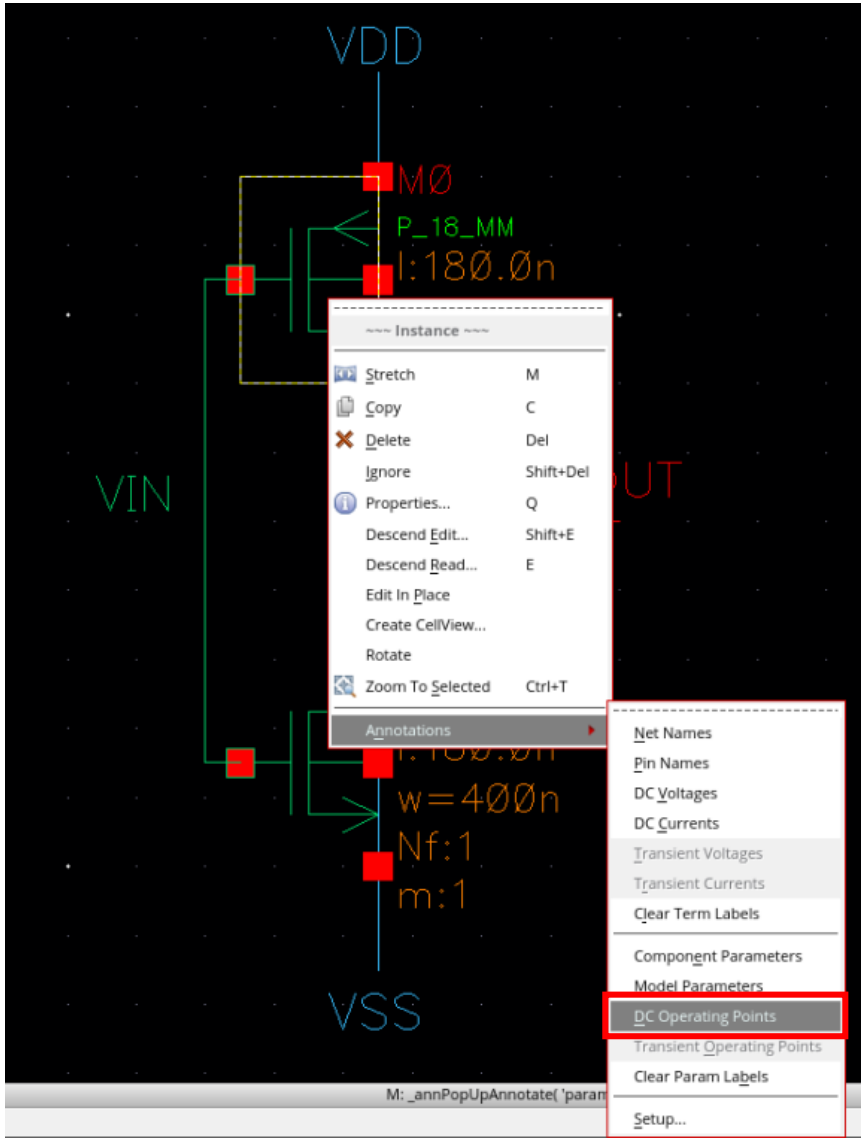


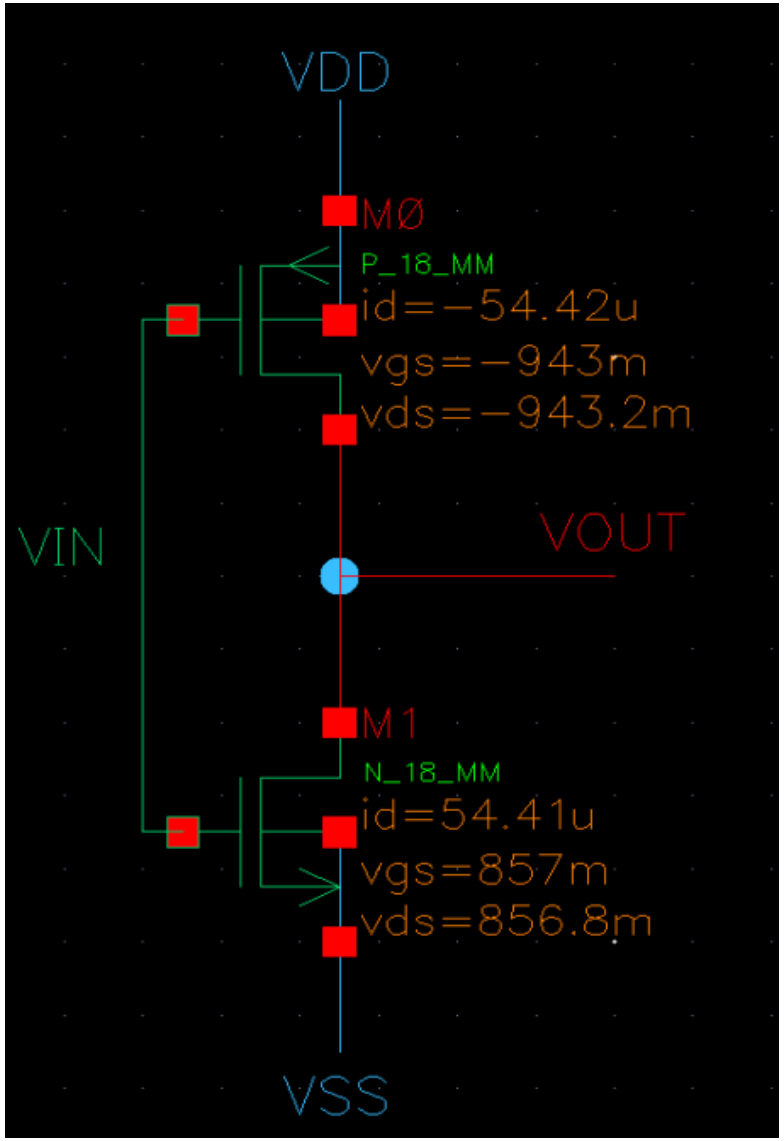
※Sweep Type
預設上是Automatic ，但如果想要看得更精細的話可以選擇Linear並且自己設置Step size為多少!!

Wave-view Analysis

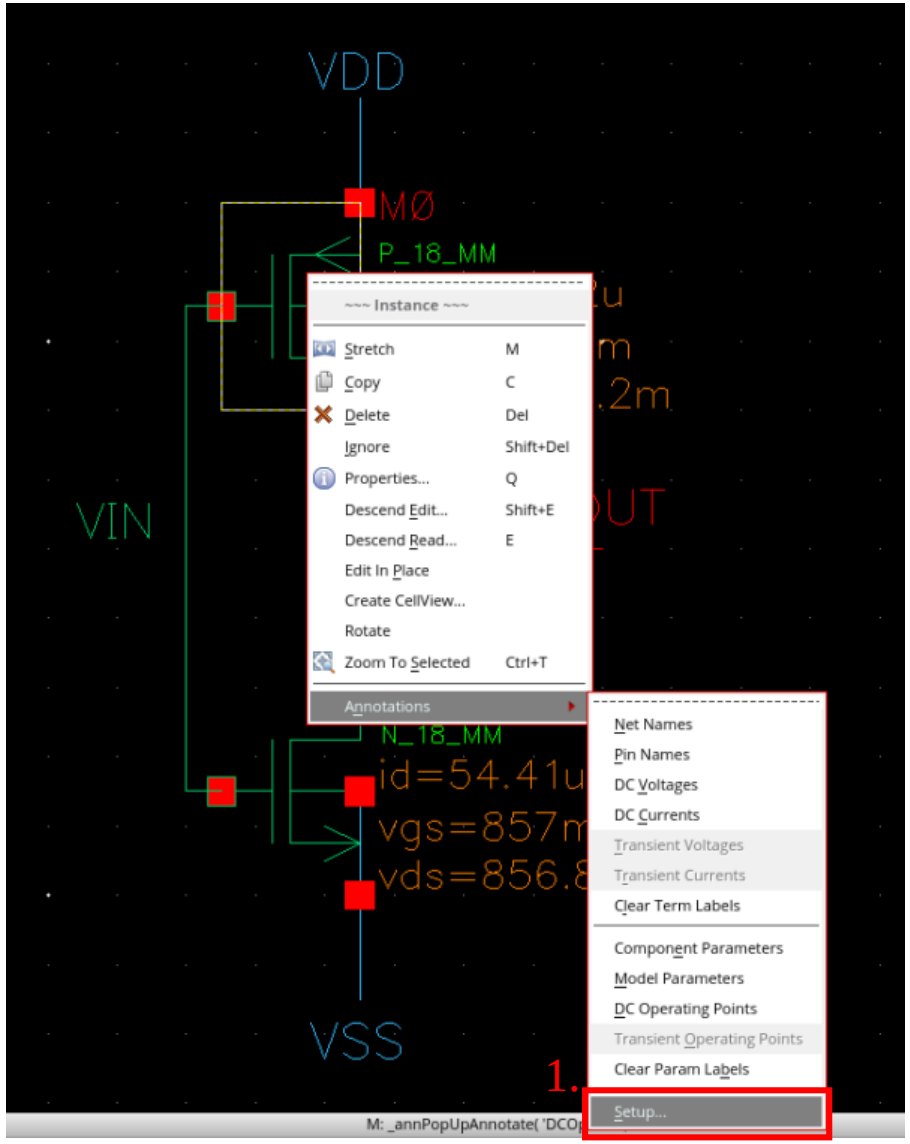


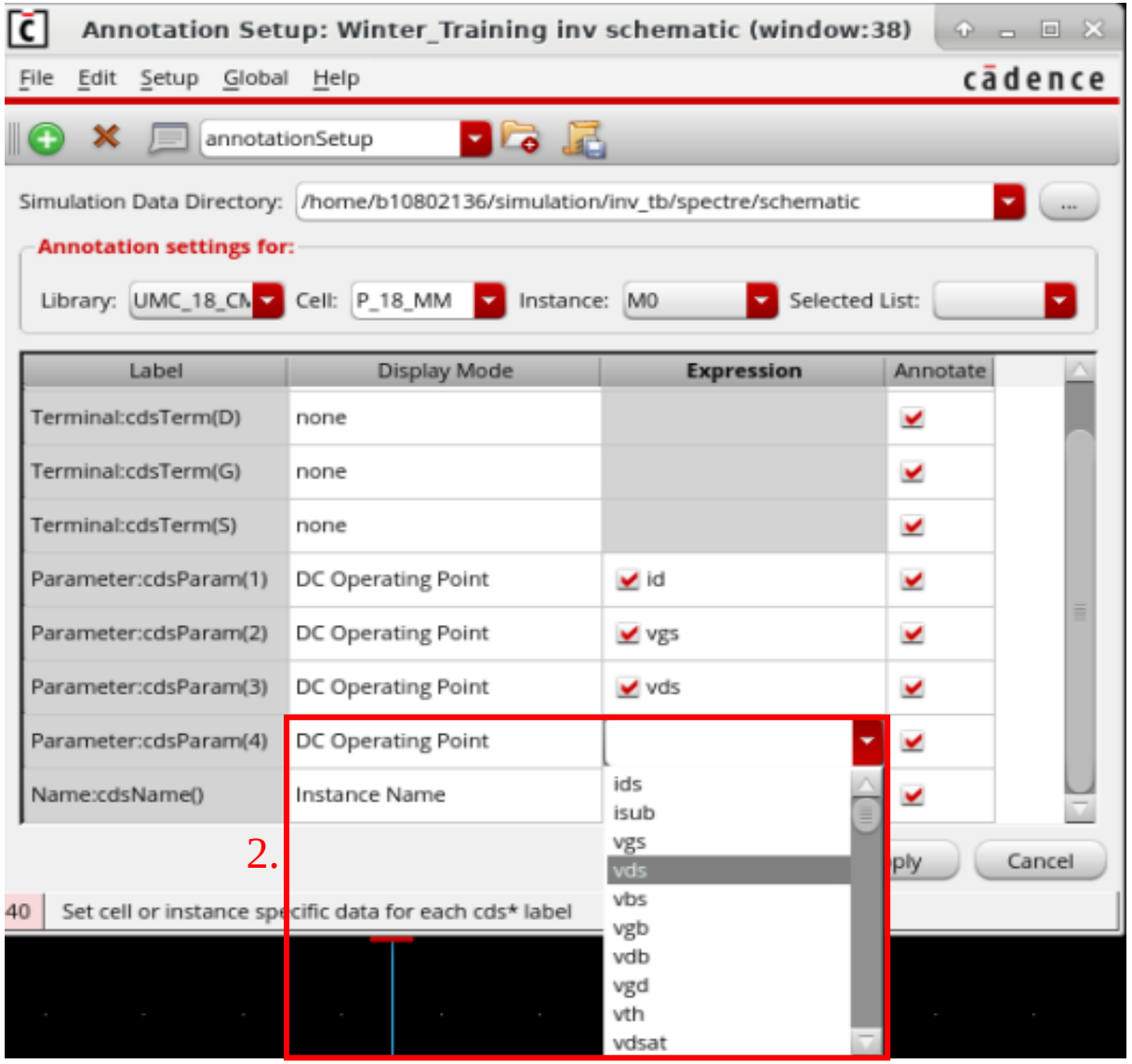
DC Operation Points



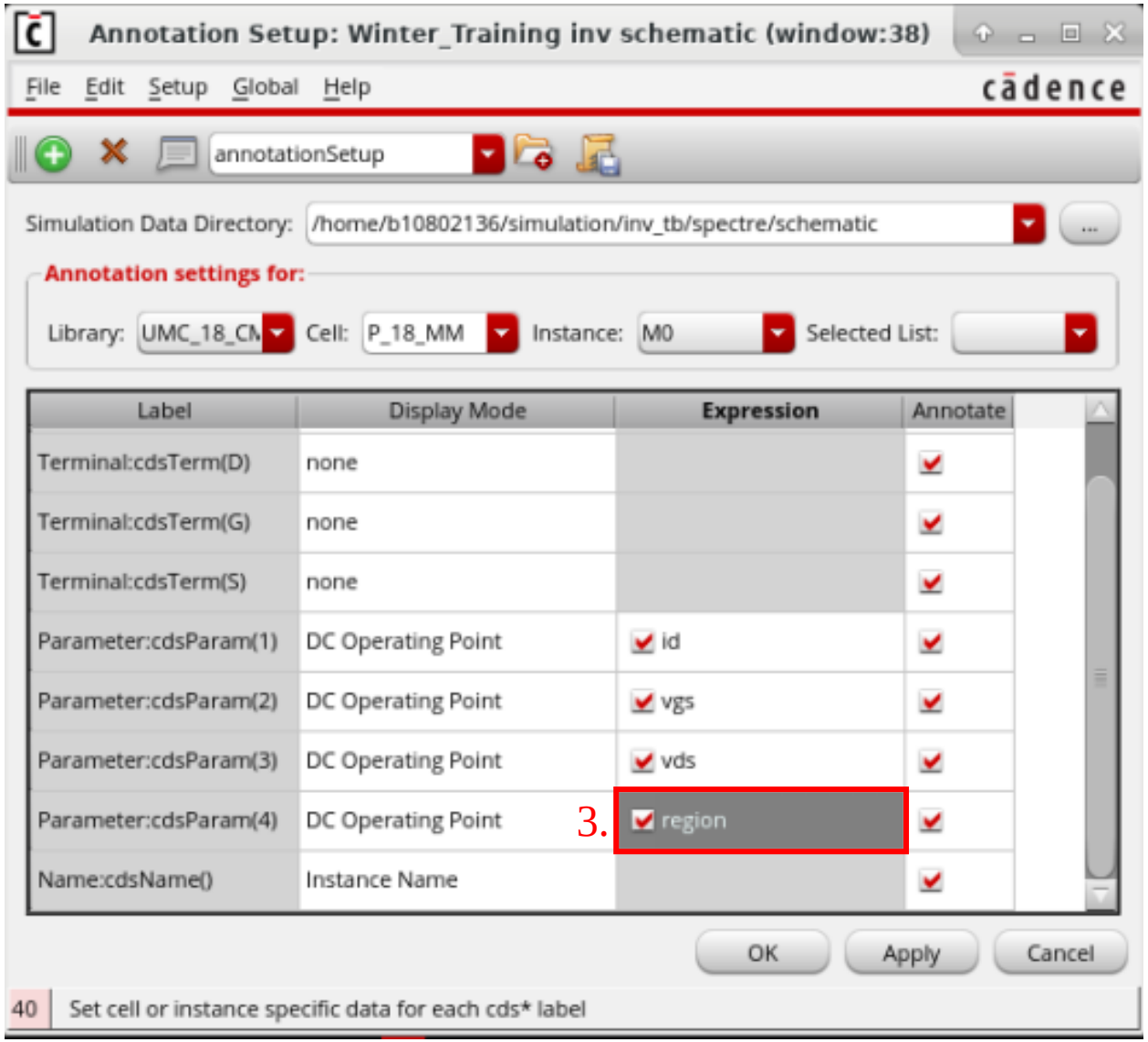


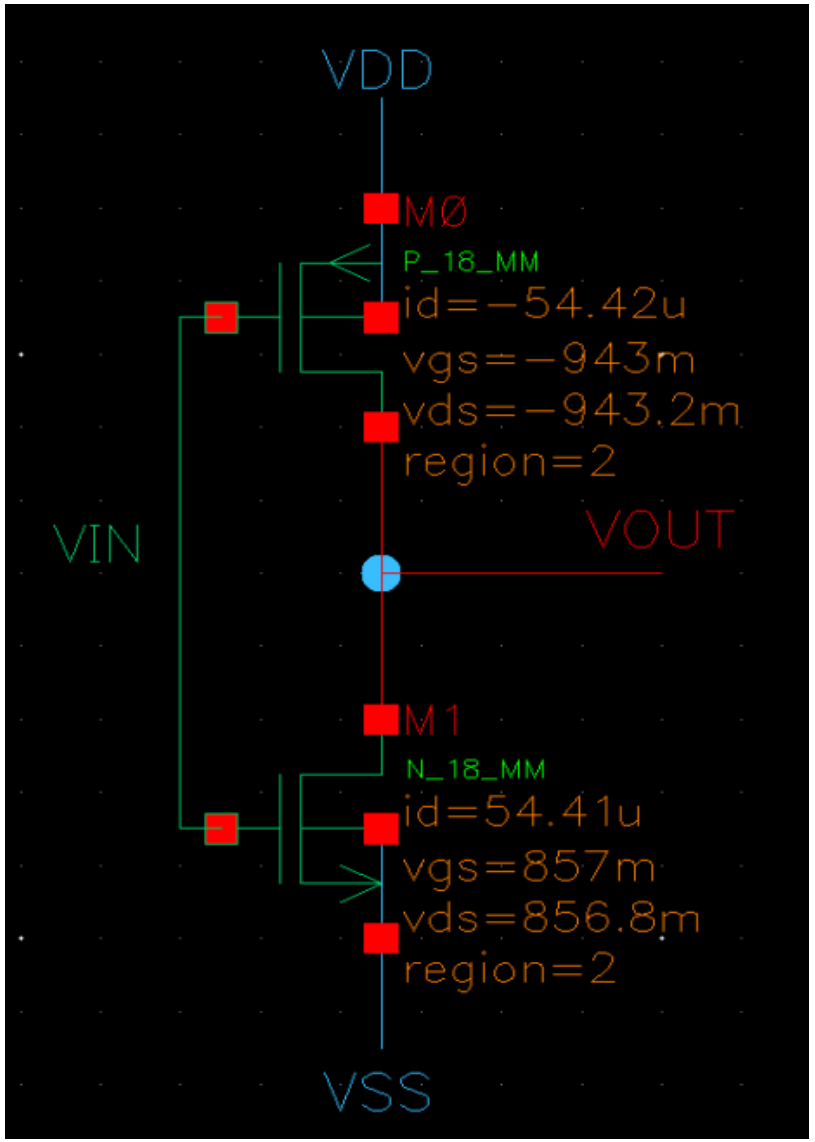
DC Operation Points





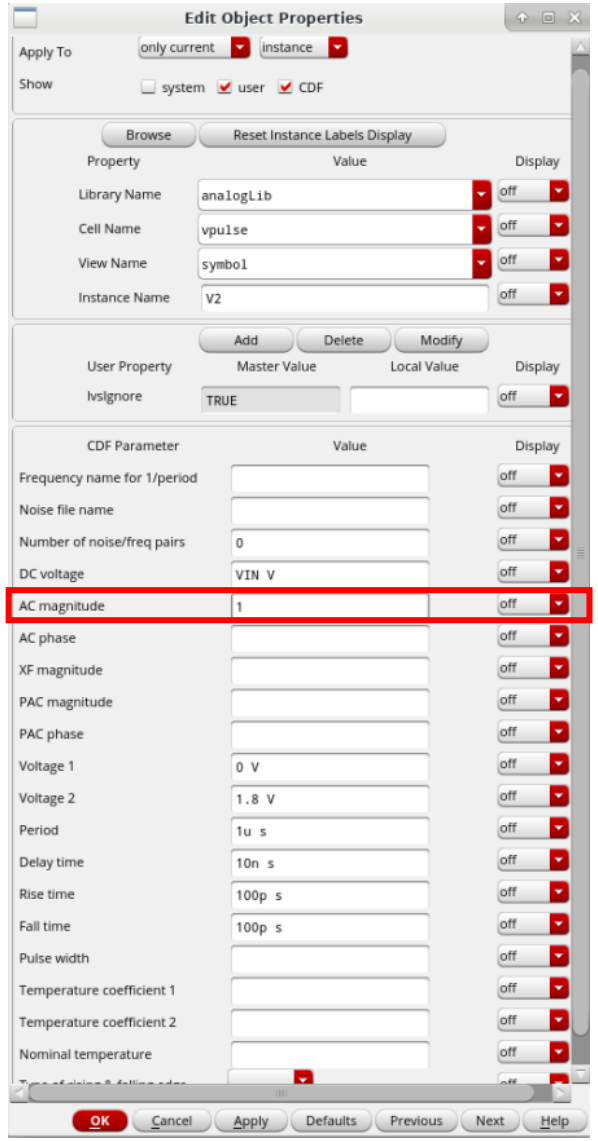
DC Operation Points

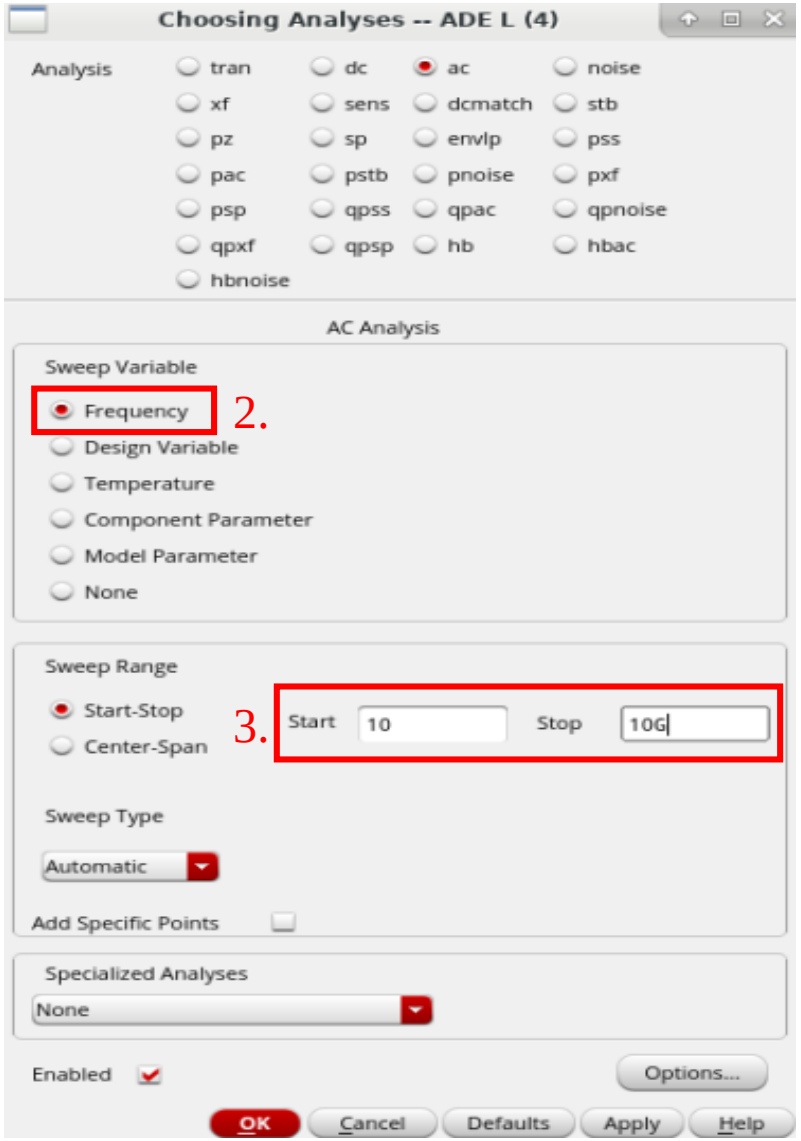




※MOS Region
0 : cut-off
1 : triode
2 : saturation
3 : subthreshold
4 : breakdown

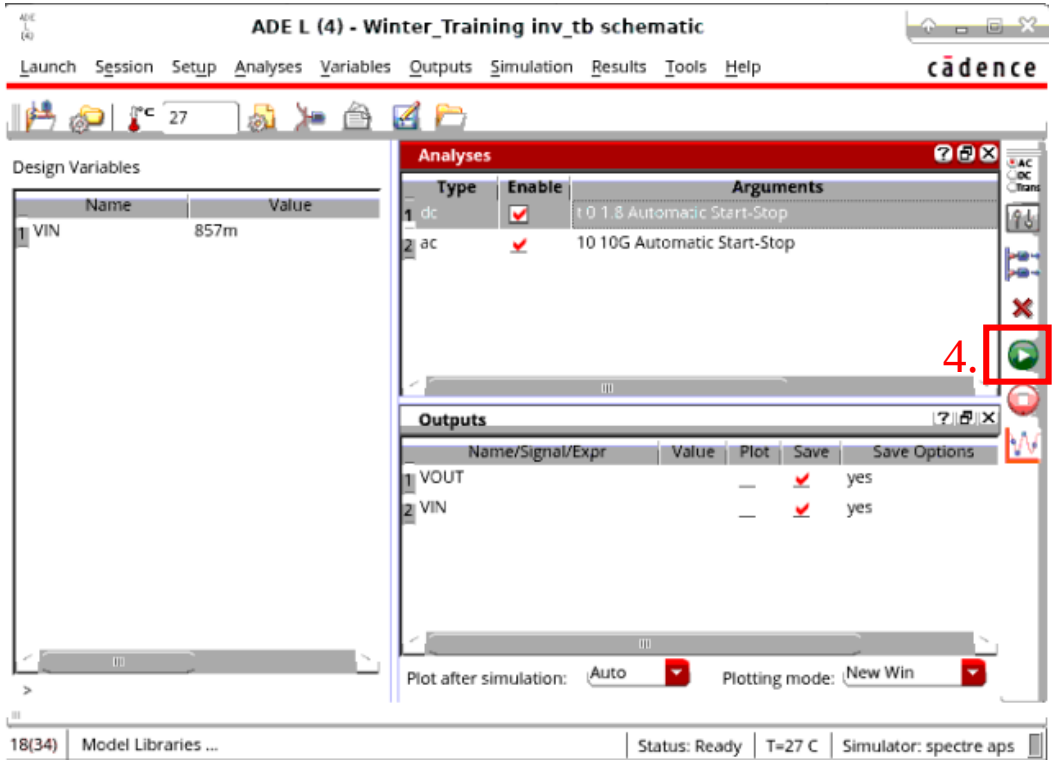
AC Analysis

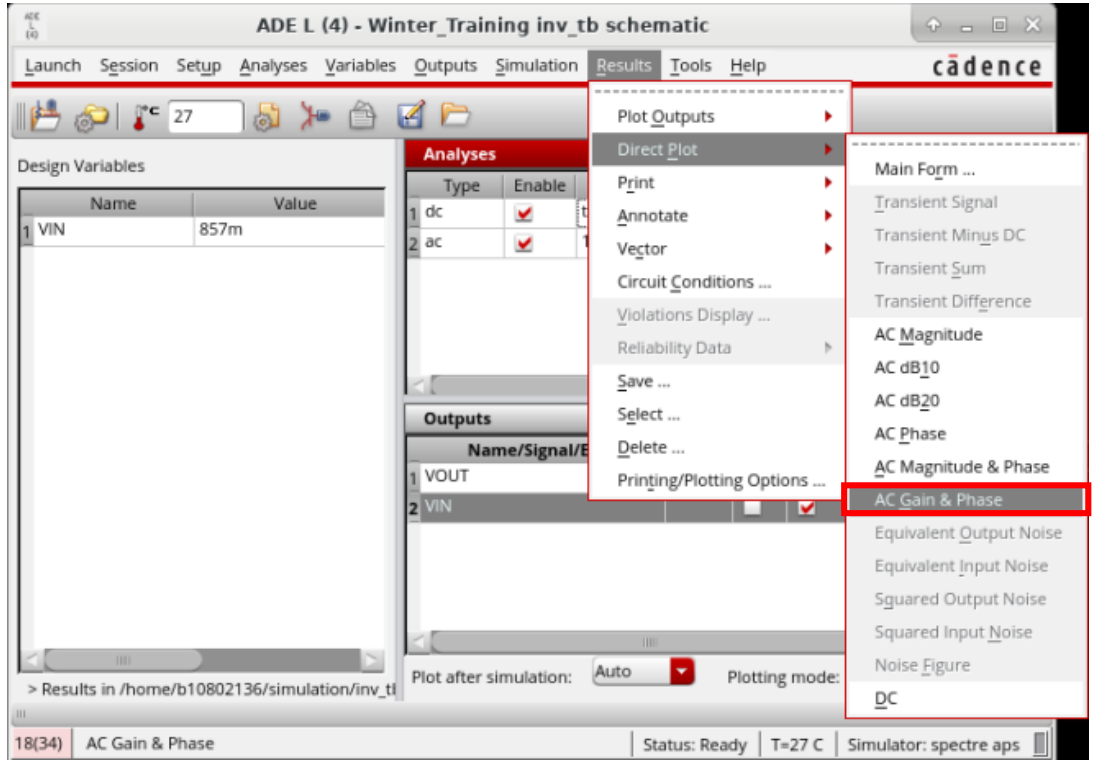




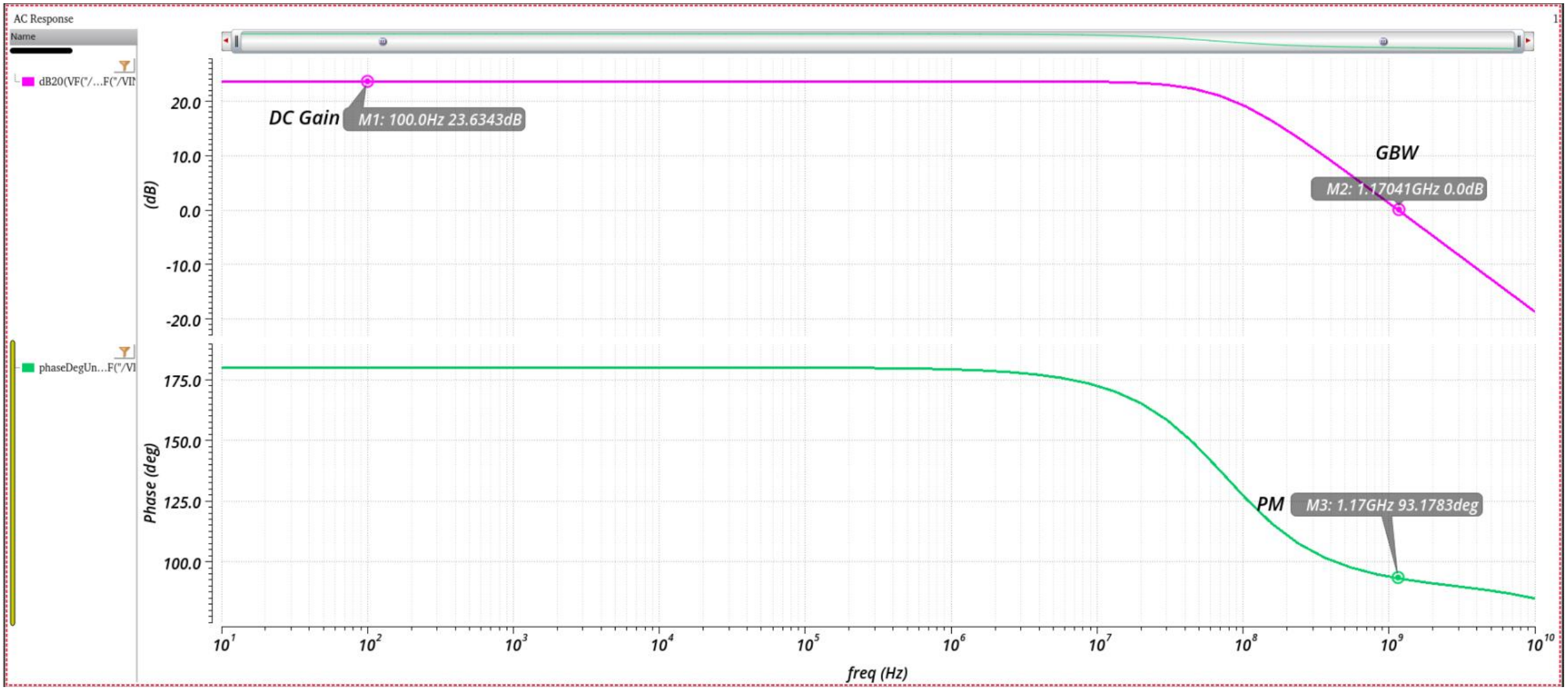
※.ac
是基於你給的直流操作點下，
去做小訊號分析的
例如我這邊的VIN給857m V

AC Analysis


ADE L (4) - Winter_Training inv_tb schematic
Launch Session Setup Analyses Variables Outputs Simulation Results Tools Help
cadence
Design Variables
Name Value
1 VIN 857m
Analyses
Type Enable Arguments
1 dc t 0 1.8 Automatic Start-Stop
2 ac 10 10G Automatic Start-Stop
4.
Outputs
Name/Signal/Expr Value Plot Save Save Options
1 VOUT yes
2 VIN yes
Plot after simulation: Auto
Plotting mode: New Win
18(34) Model Libraries ...
Status: Ready T=27 C Simulator: spectre aps


ADE L (4) - Winter_Training inv_tb schematic
Launch Session Setup Analyses Variables Outputs Simulation Results Tools Help
cadence
Design Variables
Name Value
1 VIN 857m
Plot Outputs
Direct Plot
Print
Annotate
Vector
Circuit Conditions ...
Violations Display ...
Reliability Data
Save ...
Select ...
Delete ...
Printing/Plotting Options ...
Main Form ...
Transient Signal
Transient Minus DC
Transient Sum
Transient Difference
AC Magnitude
AC dB10
AC dB20
AC Phase
AC Magnitude & Phase
AC Gain & Phase
Equivalent Output Noise
Equivalent Input Noise
Squared Output Noise
Squared Input Noise
Noise Figure
DC
5.
> Results in /home/b10802136/simulation/inv_tb
Plot after simulation: Auto
Plotting mode:
18(34) AC Gain & Phase
Status: Ready T=27 C Simulator: spectre aps

Wave-view Analysis



Types of voltage sources

analogLib : V_{dc}

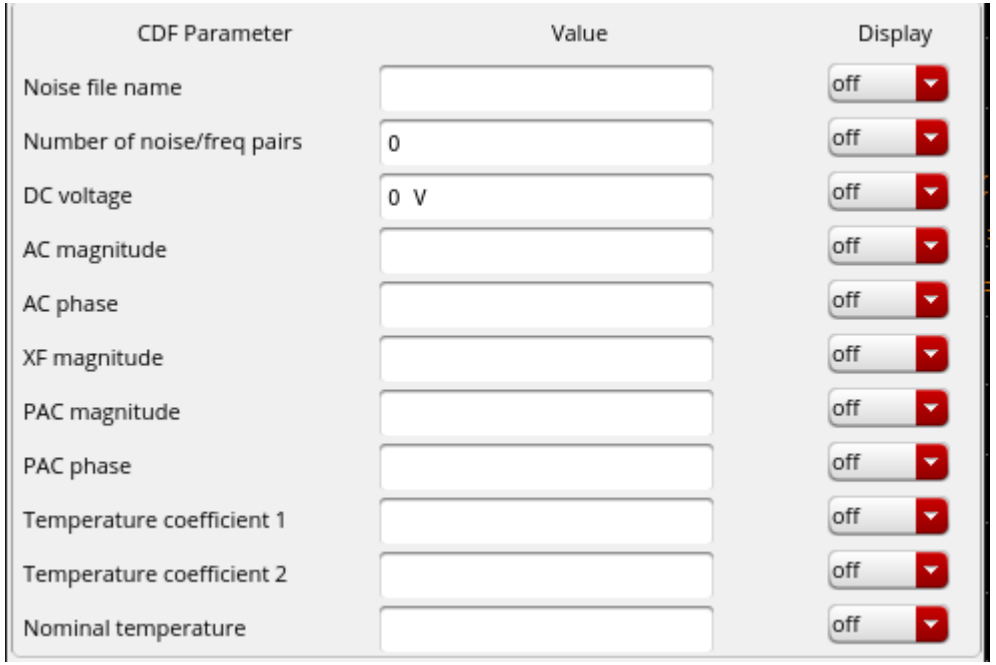
DC voltage : 跑.dc在用的，給定一個直流值。

AC magnitude : 跑.ac時在用的，基於已給定的直流操作點下，給一個小訊號的變化量 ，通常會給”1”，

注意:這邊給的1 不是真的輸入大小為1V的訊號!!

AC phase : 跑.ac時在用的，給一個相位差通常為0或180

PAC magnitude/phase : 跑.pac在用的，用法與.ac類似。



Types of voltage sources

analogLib : V_{pulse}

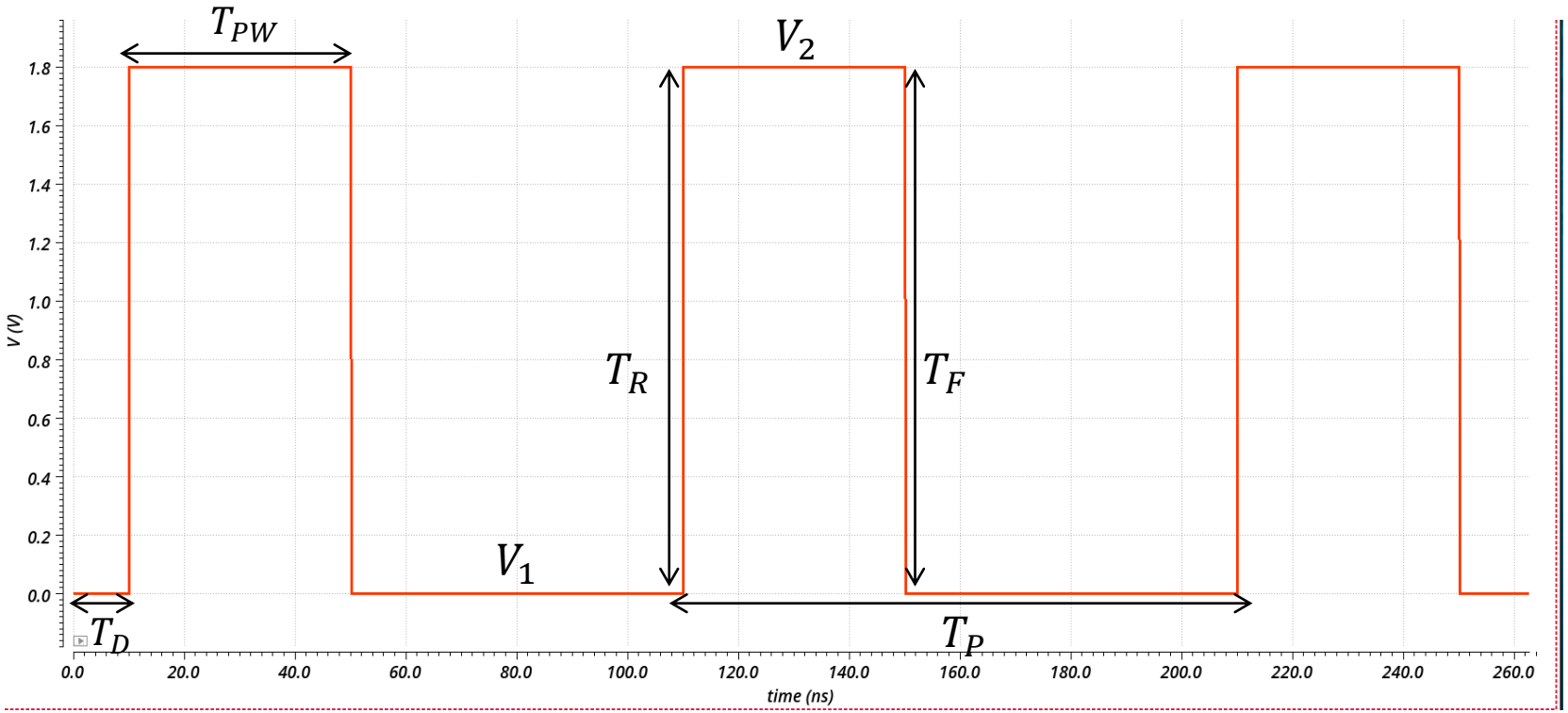
T_D : $Delay\ time$

T_R : $Rise\ time$

T_F : $Fall\ time$

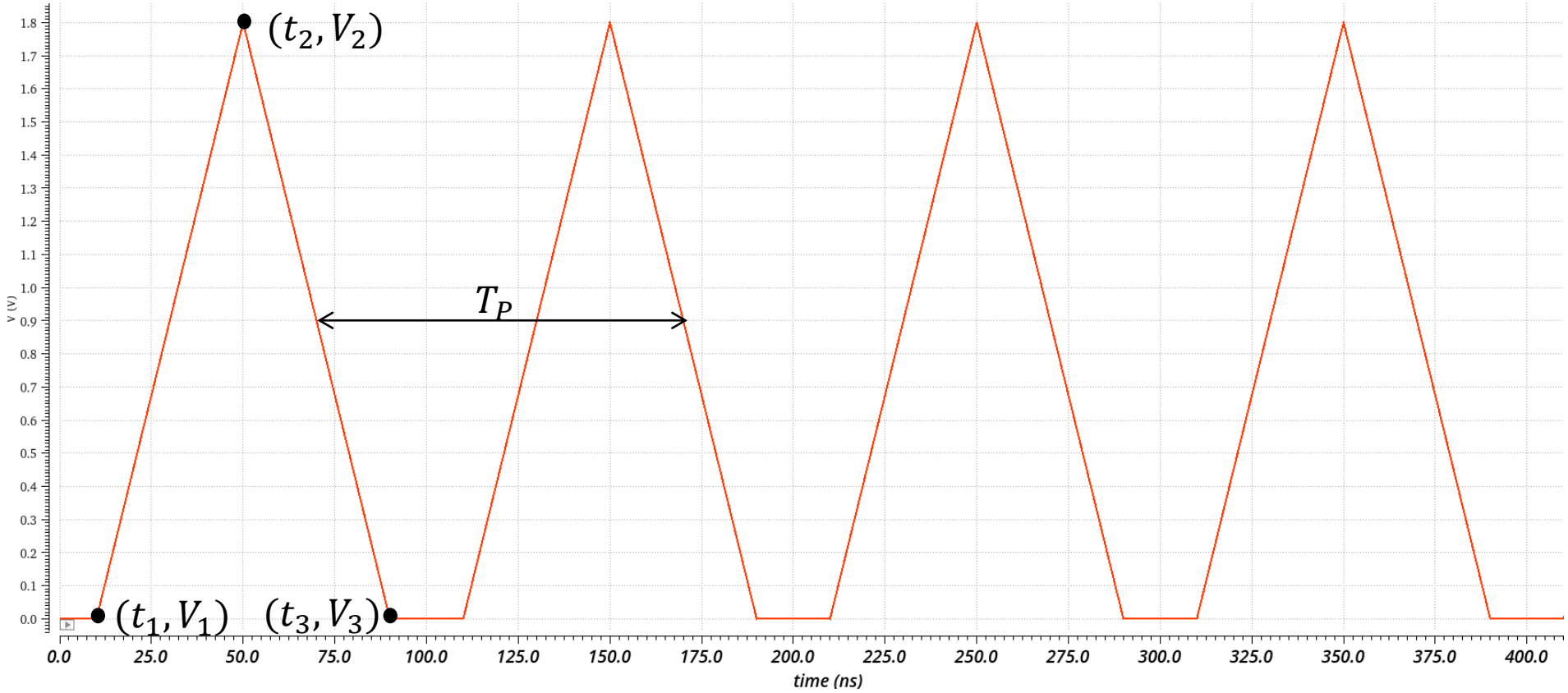
T_{PW} : $Pulse\ Width$

T_P : $Period$



Types of voltage sources

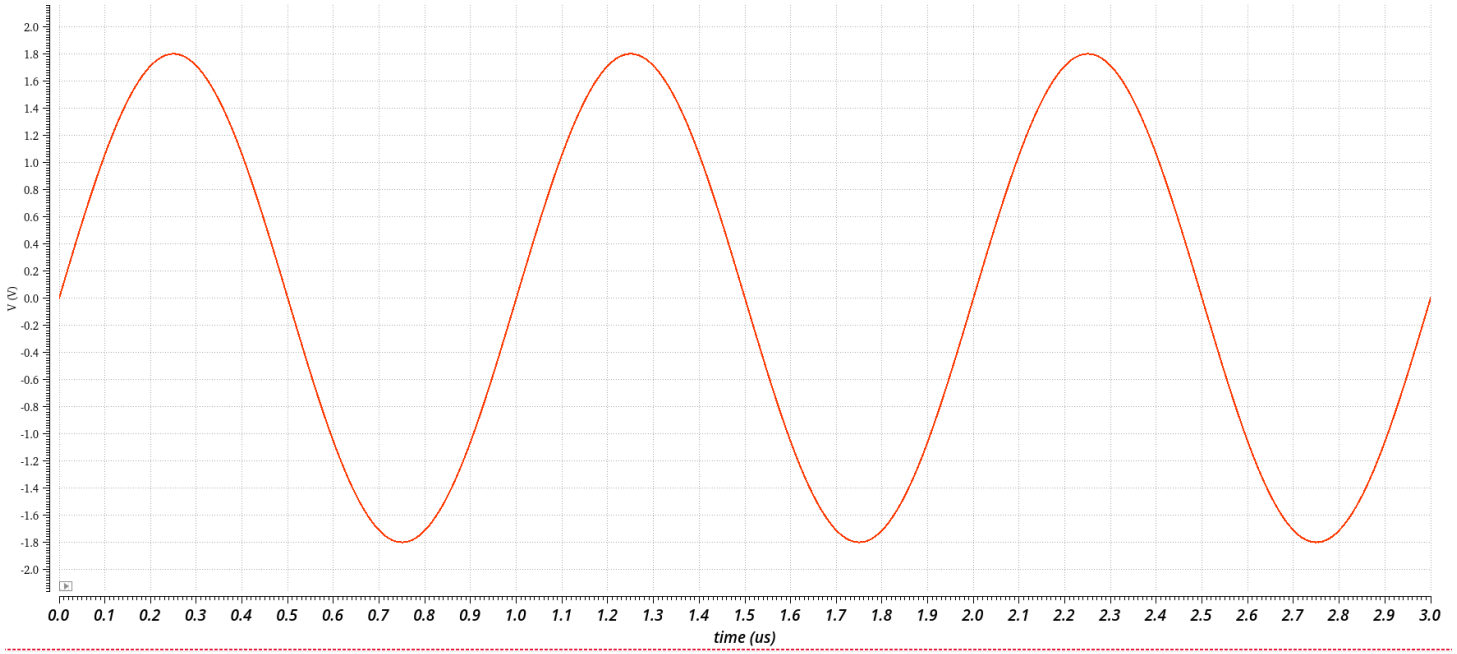
analogLib : V_{pwl}



Types of voltage sources

analogLib : V_{sin}

Amplitude:振幅大小
Frequency :頻率



CDF Parameter	Value
First frequency name	
Second frequency name	
Noise file name	
Number of noise/freq pairs	0
DC voltage	
AC magnitude	
AC phase	
XF magnitude	
PAC magnitude	
PAC phase	
Delay time	
Offset voltage	
Amplitude	1.8 V
Initial phase for Sinusoid	
Frequency	1M Hz
Amplitude 2	
Initial phase for Sinusoid 2	
Frequency 2	
FM modulation index	
FM modulation frequency	
AM modulation index	
AM modulation frequency	
AM modulation phase	
Damping factor	
Temperature coefficient 1	
Temperature coefficient 2	
Nominal temperature	
Number of FM Files	none one two

Thank You For Your Attention