Lab. 01

INSTALLATION OF CIRCUIT SIMULATOR

Installation

1. LTspice
   – Download LTspice at "http://www.analog.com/" and install it.
2. Model parameters of MOSFET
   – http://cmosedu.com/cmos1/book.htm
   – Right click and save the file cmosedu_models.txt
   – Rename the saved file from cmosedu_models.txt to cmos.lib
   – The file cmos.lib should be located in the same folder as the circuit file (name.asc) or C:¥Users¥{User_Name}¥Documents¥LTspiceXVII¥lib¥cmp¥.
3. Symbols of MOSFET
   – The symbol nmos4, and pmos4 provided by Linear Technology.

[Note] Files of schematic and symbol

- Use the menu [File] - [Save As] to save the file of the schematic and symbol data for the first time.
  - Do not use [File] - [Save], because the default name is used.
  - The extension is automatically added.
    - Schematic filename = *.asc
    - Symbol filename = *.asy

DC analysis of MOSFET

1. Refer to next page and simulate the $I_{dsn} - V_{dsn}$ characteristic and the I_{dsn} - V_{gsn} characteristic with the LTspice.
2. Simulate the I_{dsp} - V_{dsp} characteristic and the I_{dsp} - V_{gsp} characteristic of p-ch MOSFET as well as the n-ch MOSFET.

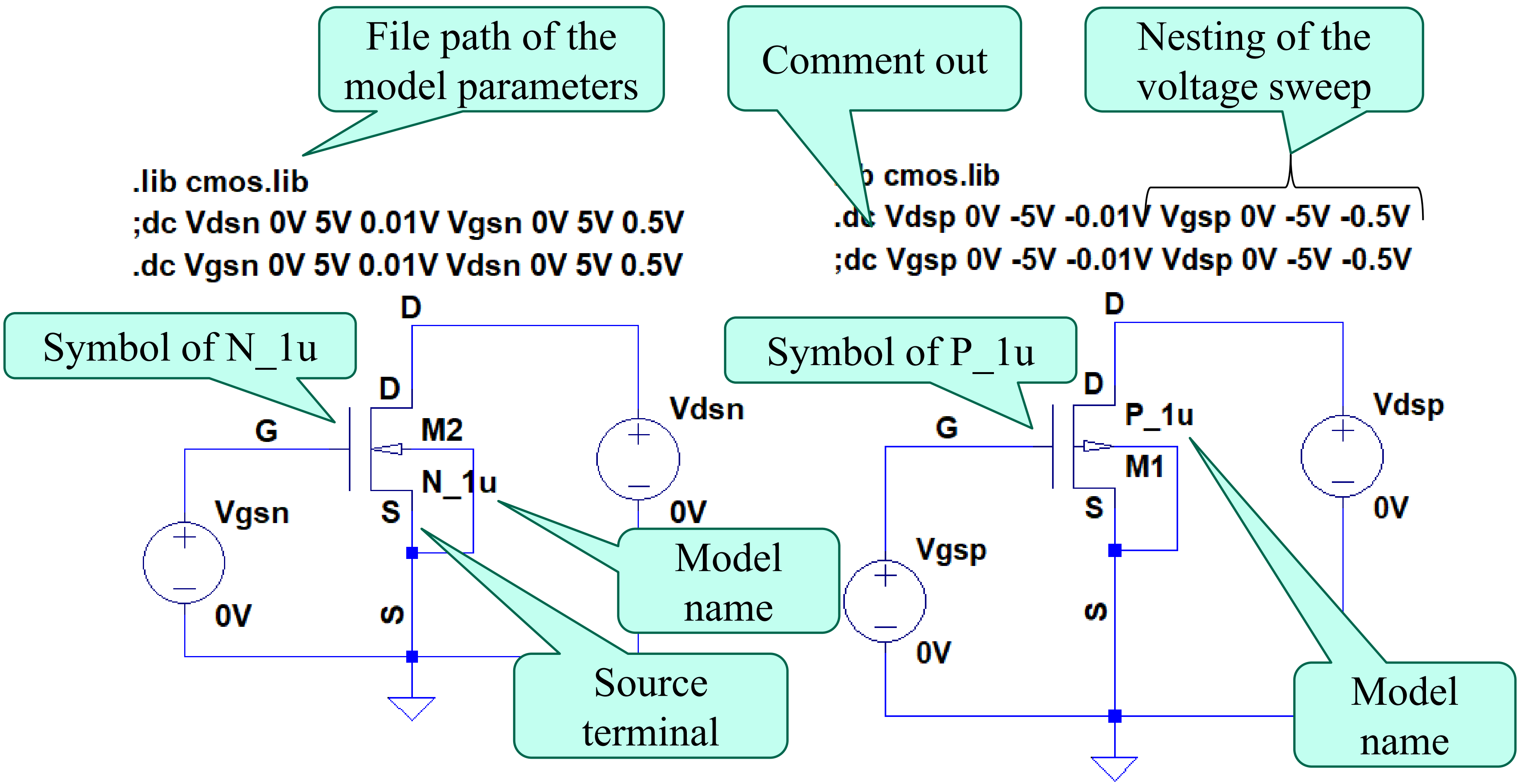
Reference URL of LTspice

http://jaco.ec.t.kanazawa-u.ac.jp/edu/ec2/ltspice/

Reference Book of LTspice

https://www.kohgakusha.co.jp/books/detail/978-4-7775-1936-1

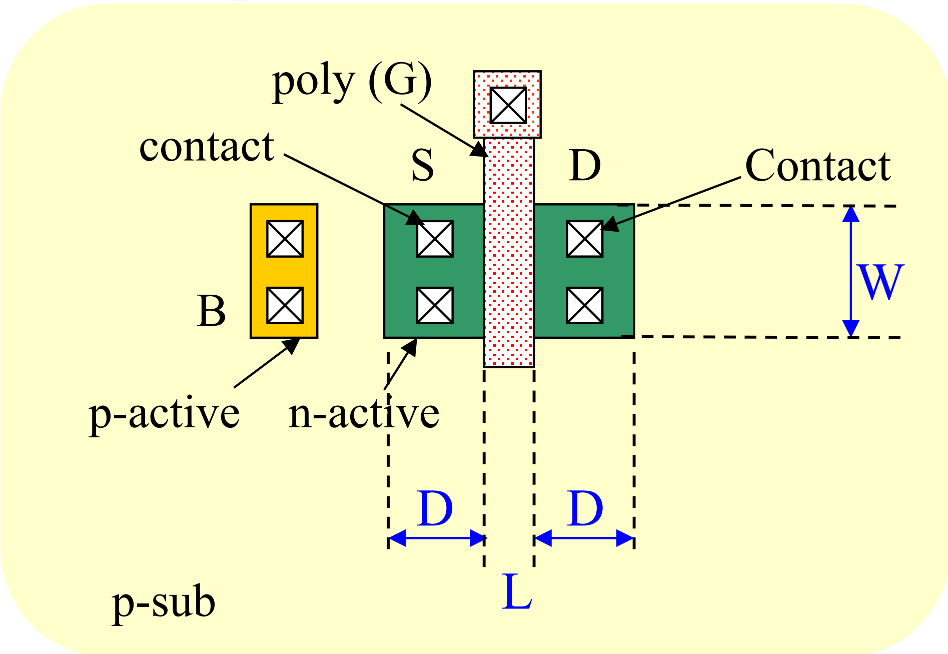
Example -1 (Schematic)



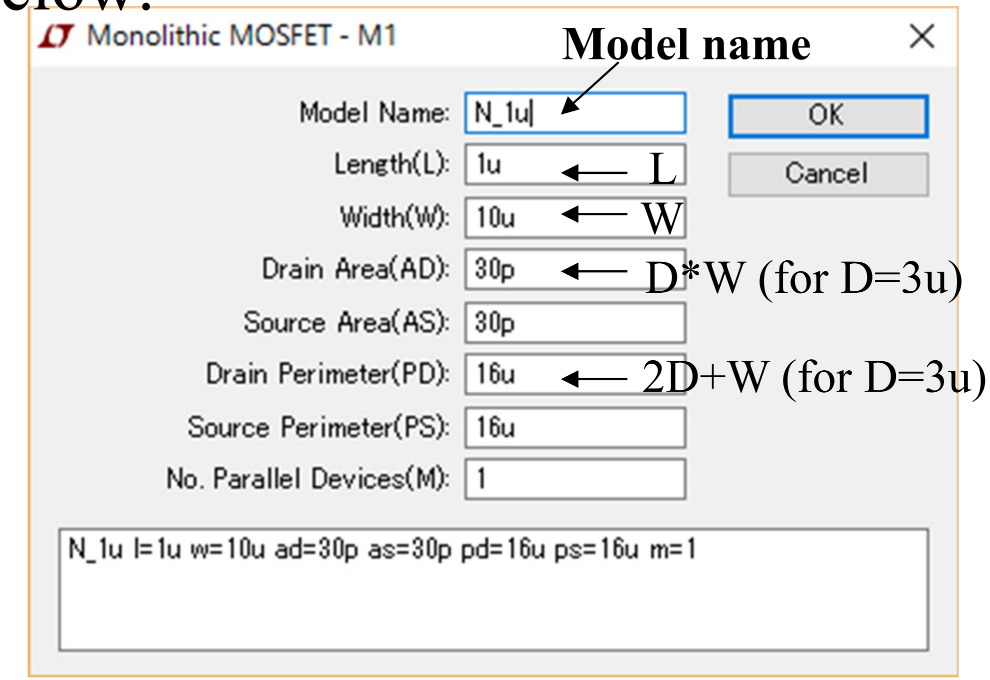
n-ch MOSFET p-ch MOSFET

Example -2 (Size of MOSFET)

1. Right click the symbol of MOSFET
2. Input the values of the MOSFET parameters on the options window as stated below.



Layout of MOSFET



Parameters of MOSFET

Example -3 (Model parameters)

Open up the file of model parameters and confirm the model name.

Model name

Device model of n-ch MOSFET

Type of the device model

Model parameters

```
.model N_1u nmos level  = 3
+ TOX    = 200E-10       NSUB   = 1E17          GAMMA  = 0.5
+ ▪▪▪▪
```

The four models are described in the file. The model names are N_1u, N_50n, P_1u, and P_50n.

Technology	n-ch MOSFET	p-ch MOSFET	Power supply voltage
1um (long channel)	N_1u	P_1u	5.0V
50nm (short channel)	N_50n	P_50n	1.0V