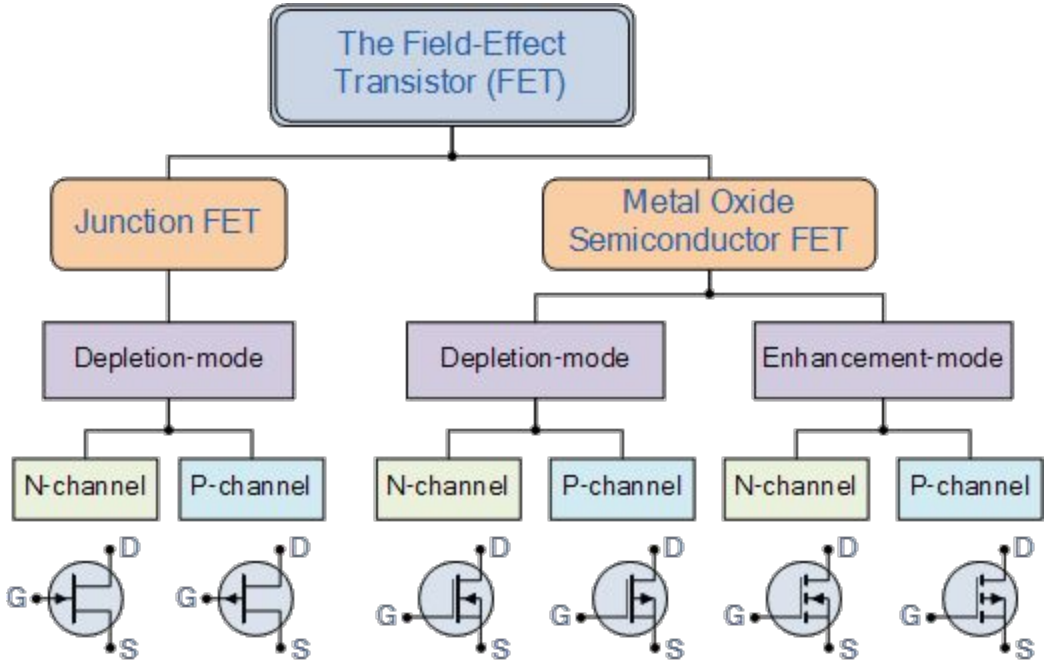
Gates in CMOS

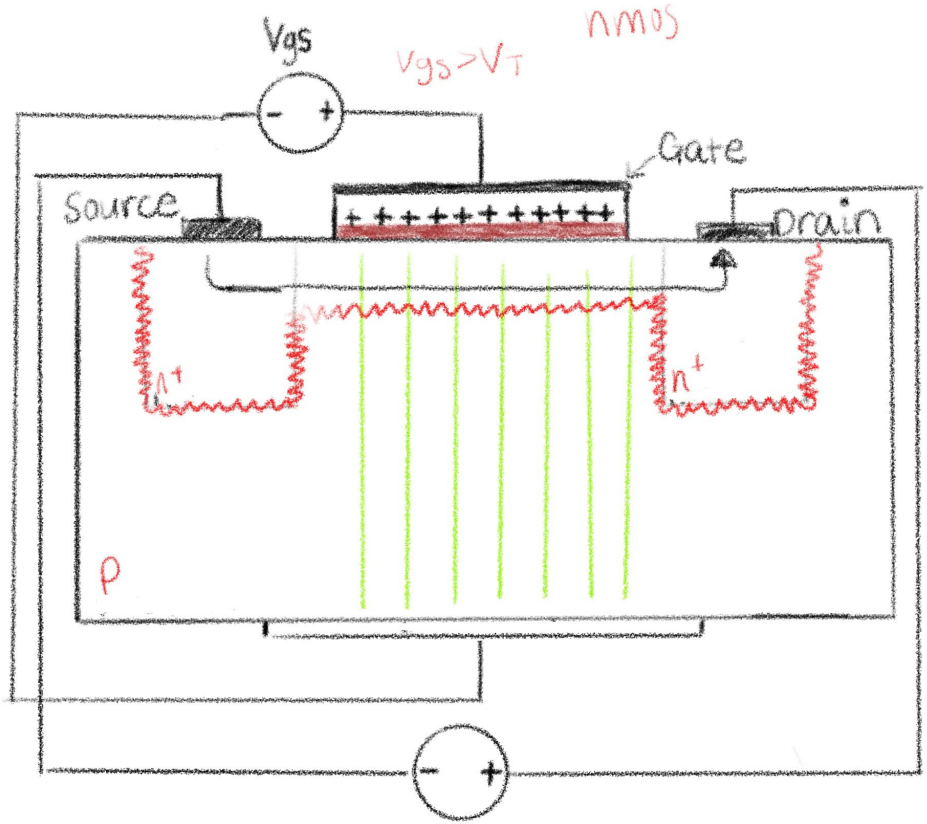
CMOS

- CMOS stands for “complementary metal-oxide semiconductor”
- Used to construct:
  - digital circuitry
  - memory
  - some analog circuits

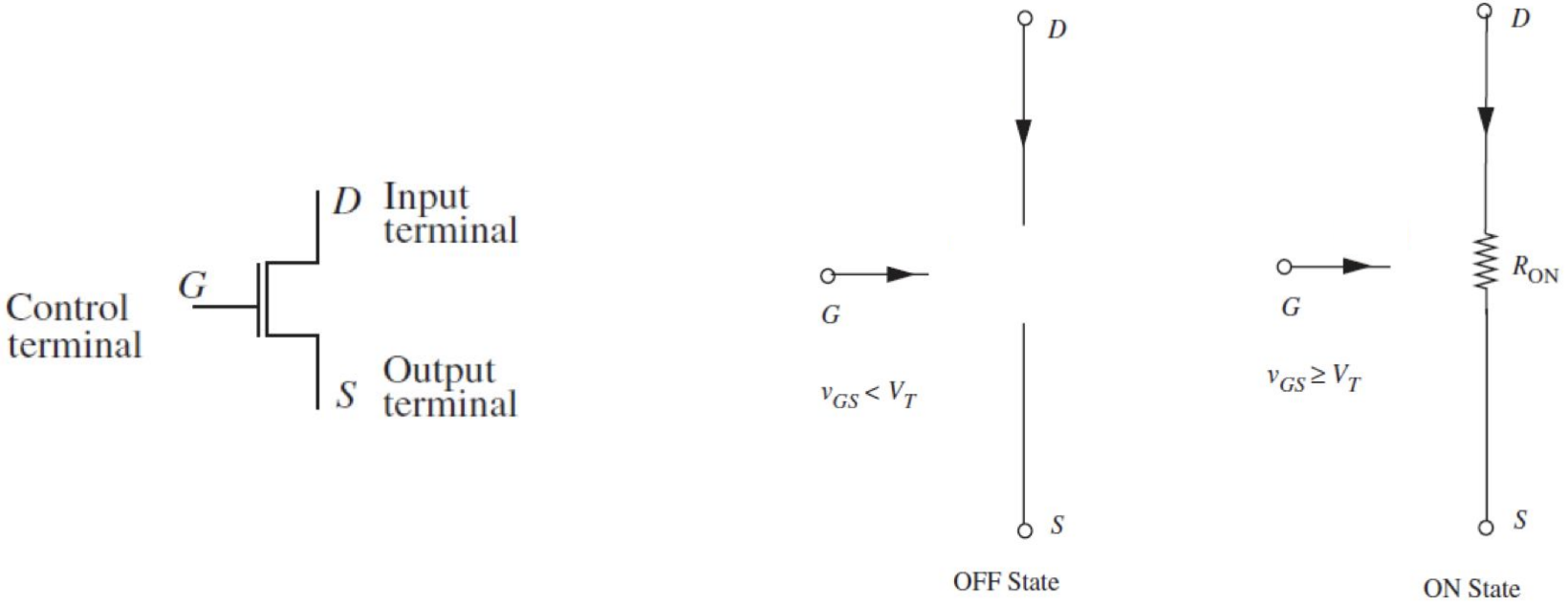
FETs


The Field-Effect Transistor (FET)
Junction FET
Metal Oxide Semiconductor FET
Depletion-mode
Depletion-mode
Enhancement-mode
N-channel
P-channel
N-channel
P-channel
N-channel
P-channel
D
G
S

How they work



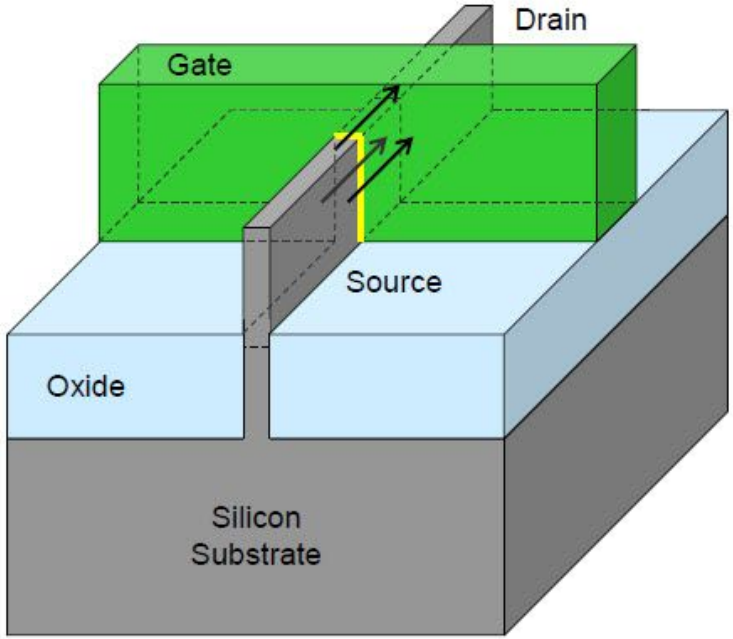
SR Model for MOSFET



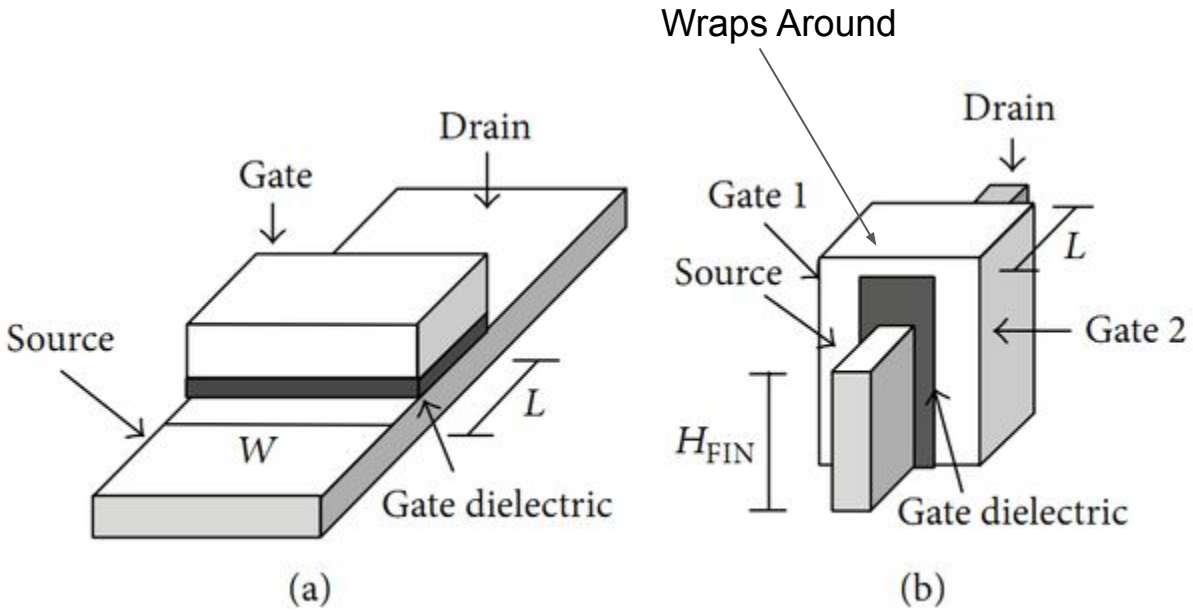
http://www-inst.eecs.berkeley.edu/~ee40/su10/lectures/lec15/lecture15_07_29_2010.ppt

FinFET

- Has the same functions as MosFets
- When gate electrode is energized it has more control due to it surrounding the channel



MosFET vs FinFET



MosFET

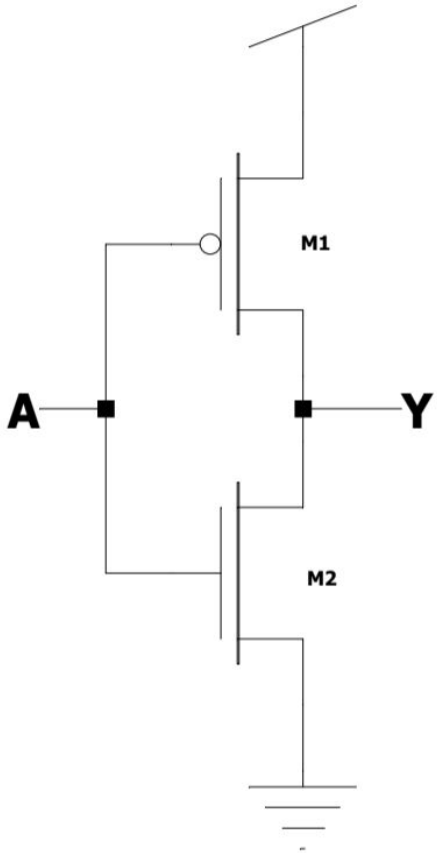
FinFET

NOT (Inverter)

A	Y
0	1
1	0

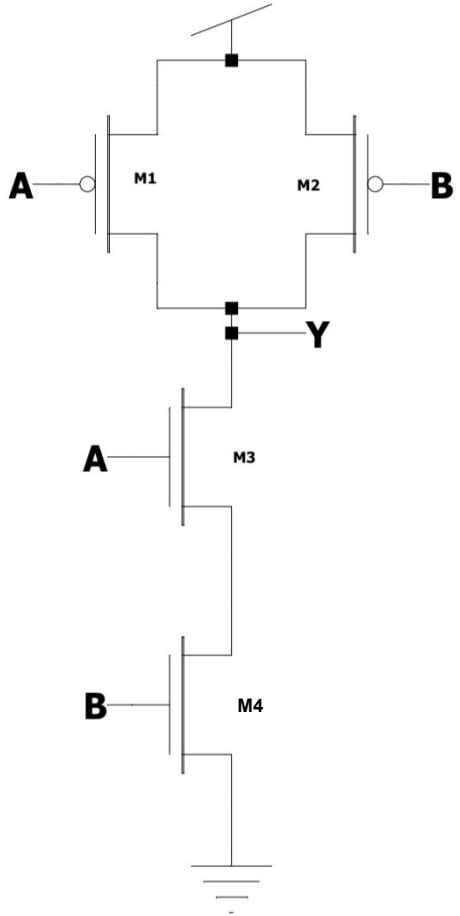
M1		
A	S	D
0	1	S
1	1	X

M2		
A	S	D
0	0	X
1	0	S



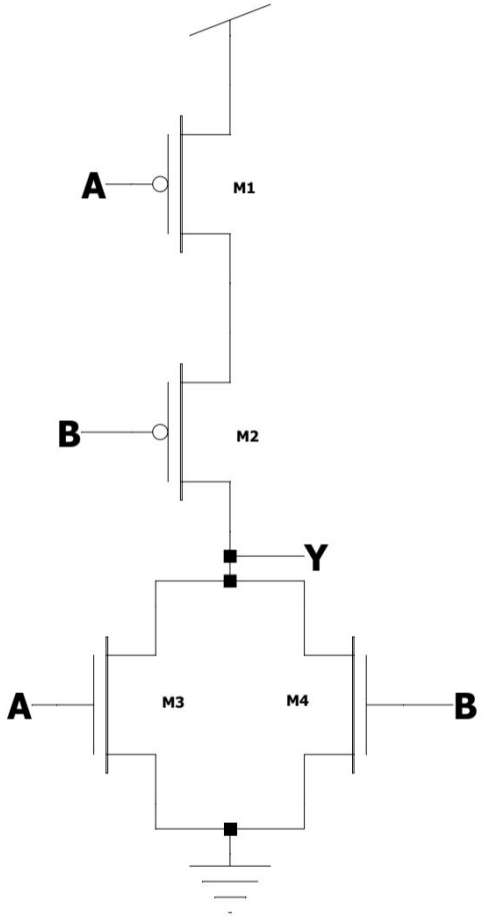
NAND

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0



NOR

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0



Pass-Transistor Logic -> Passgates

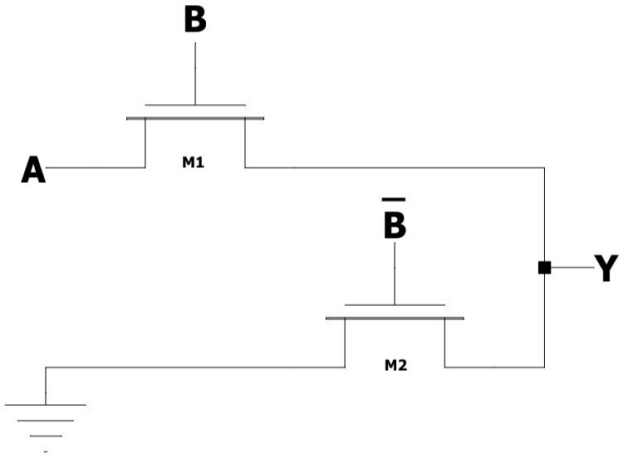
- Fewer devices
- Eliminates redundant transistors
- Lower switching energy

Drawbacks:

Vt loss -> static power consumption + slower transition

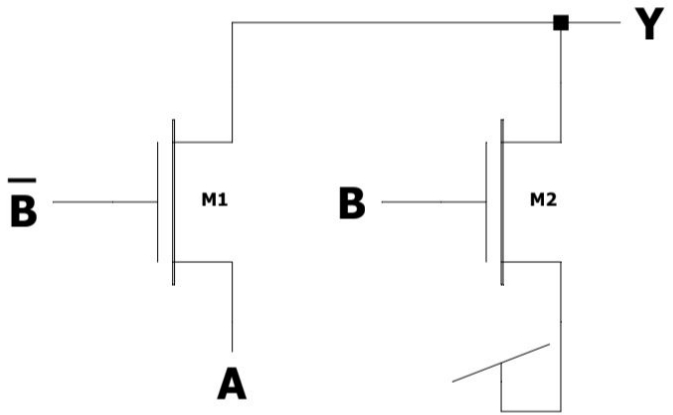
Passgate AND

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1



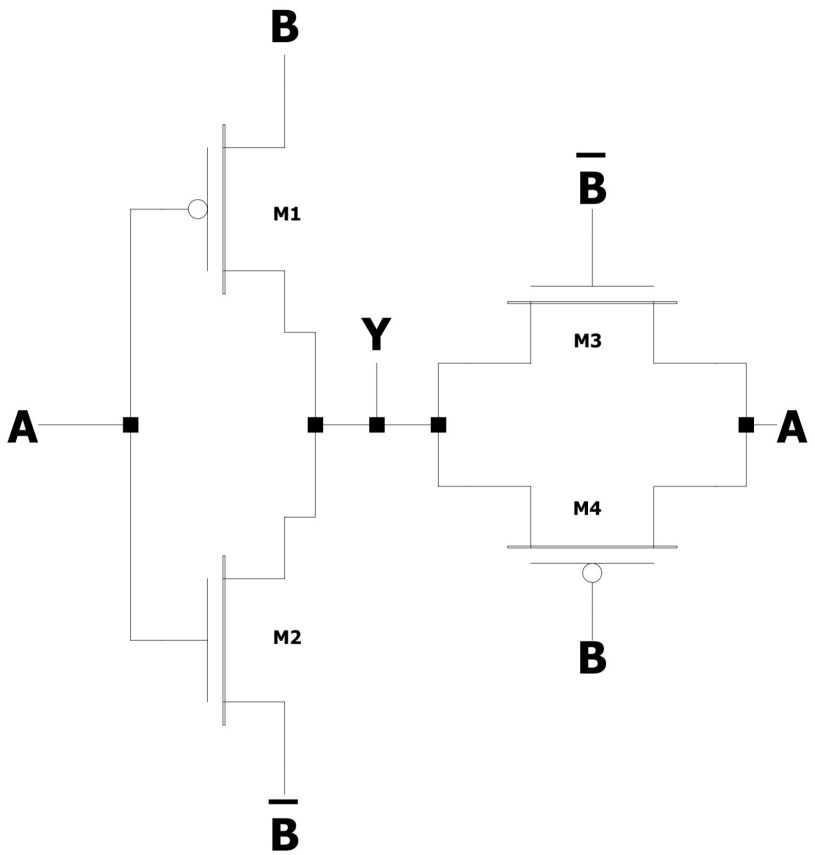
Passgate OR

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1



Passgate XOR

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0



Questions?