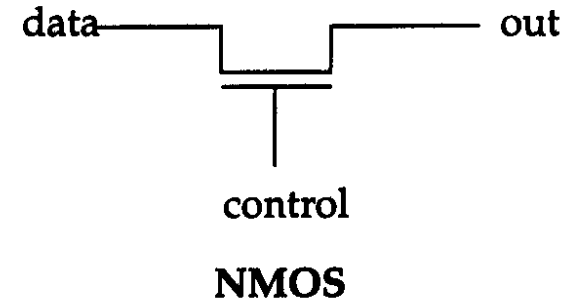


# Switch Level Modeling



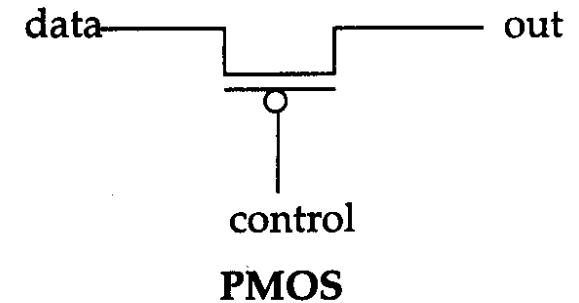
# Switch modeling elements

- MOS switches
  - **nmos**
  - **pmos**
- nmos (out, data, control)
- pmos (out, data, control)



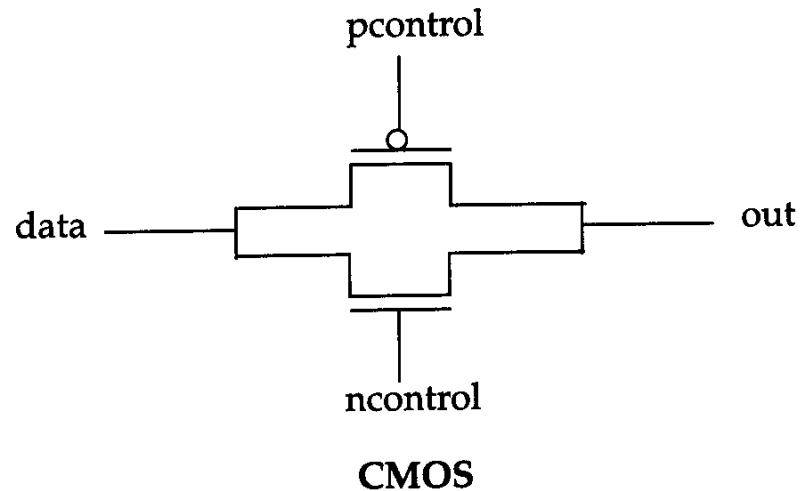
nmos	control			
	0	1	x	z
0	z	0	L	L
1	z	1	H	H
x	z	x	x	x
z	z	z	z	z

pmos	control			
	0	1	x	z
0	0	z	L	L
1	1	z	H	H
x	x	z	x	x
z	z	z	z	z



# Switch modeling elements

- CMOS switches
  - nmos (out, data, ncontrol, ncontrol)



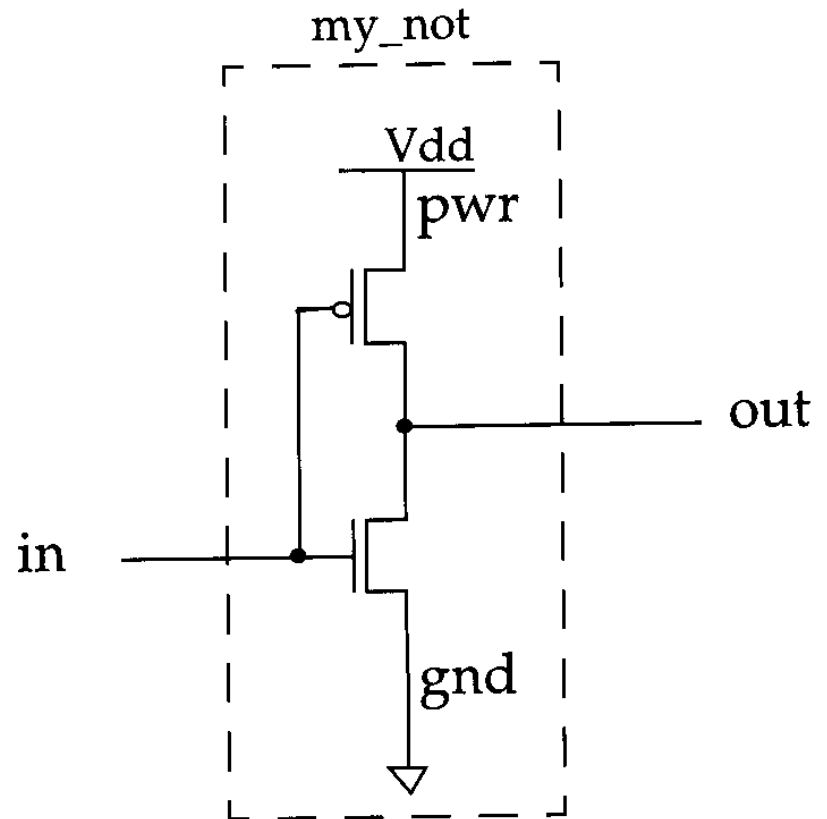
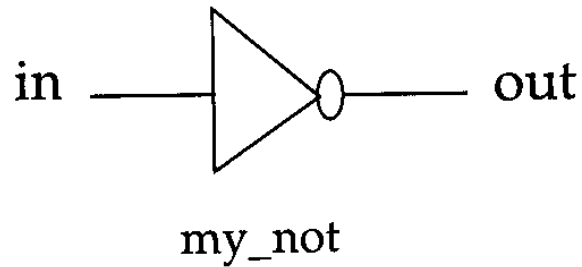
- Power and ground
  - **supply1, supply0**

```
supply1 vdd;  
supply0 gnd;
```

```
assign a = vdd; //Connect a to vdd  
assign b = gnd; //Connect b to gnd
```



# CMOS inverter



```
//Define an inverter using MOS switches
module my_not(out, in);

output out;
input in;

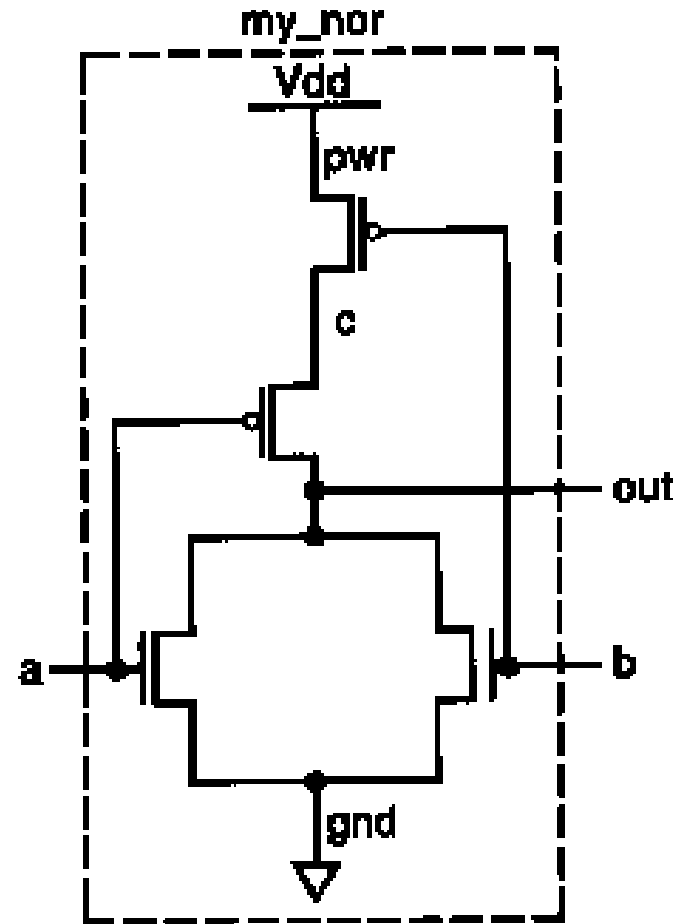
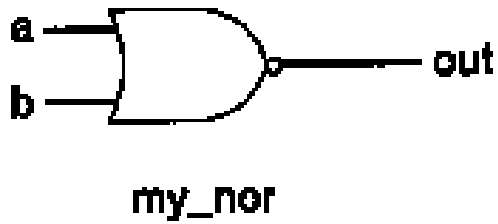
//declare power and ground
supply1 pwr;
supply0 gnd;

//instantiate nmos and pmos switches
pmos (out, pwr, in);
nmos (out, gnd, in);

endmodule
```



# CMOS NOR gate



# CMOS NOR gate

```
//Define our own nor gate, my_nor
module my_nor(out, a, b);

output out;
input a, b;

//internal wires
wire c;

//set up power and ground lines
supply1 pwr;    //pwr is connected to Vdd (power supply)
supply0 gnd ;  //gnd is connected to Vss(ground)

//instantiate pmos switches
pmos (c, pwr, b);
pmos (out, c, a);

//instantiate nmos switches
nmos (out, gnd, a);
nmos (out, gnd, b);

endmodule
```

---