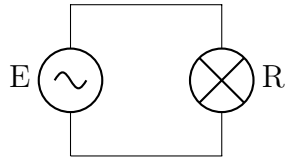


# TikZ tricks

## Stop wasting your time on tex.stackexchange.com

### 1 Basic circuits

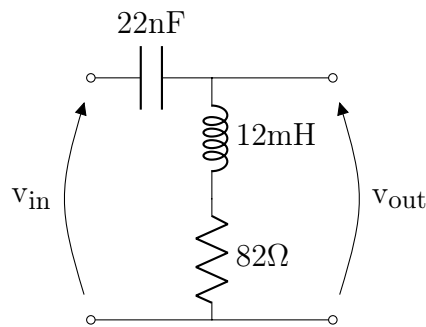
#### 1.1 Voltage source and lamp



```
\begin{circuitikz}\draw
  (0,0) to [sinusoidal voltage source, l=$E$] (0,2)--(2,2) to [lamp, l=$R$] (2,0)
  \to --(0,0);
\end{circuitikz}
```

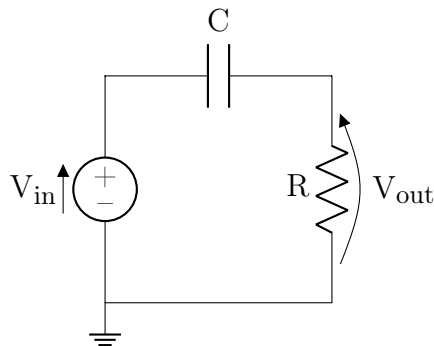
### 2 Filters

#### 2.1 RLC - Out on RL



```
\begin{circuitikz}[scale=0.8]\draw
  (0,0) to [open, v^>=$v_{in}$,o-o] (0,4) to [C,l=$22nF$] (2,4) to [L,l=$12mH$]
  \to (2,2) to [R,l=$82\Omega$] (2,0) to [short] (0,0)
  (2,4) -- (4,4) to [open, v^<=$v_{out}$,o-o] (4,0) -- (2,0);
\end{circuitikz}
```

#### 2.2 RC high-pass

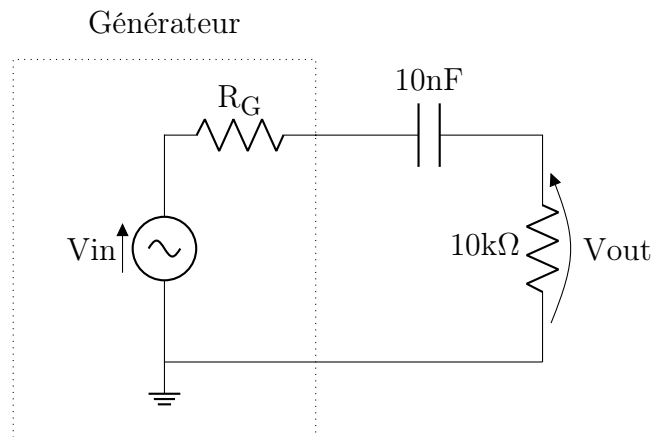


```

\begin{circuitikz} \draw
(0,0) node[ground]{}
to[american voltage source, v=$V_{in}$, invert] (0,3)
to[C, l=$C$] (3,3)
(3,0) to[R, l=$R$, v=$V_{out}$] (3,3)
(3,0)--(0,0);
\end{circuitikz}

```

## 2.3 RC high-pass with generator

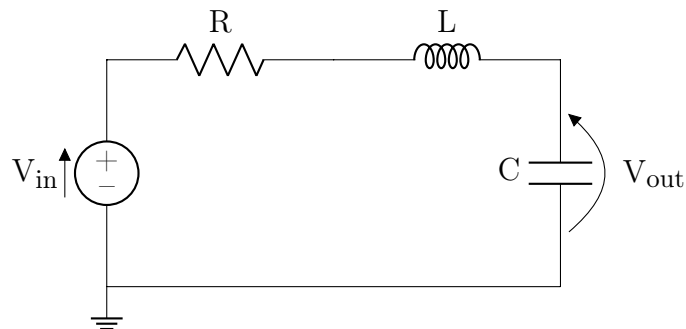


```

\begin{circuitikz} \draw
(0,0) node[ground]{}
to[sinusoidal voltage source, v=$V_{in}$] (0,3)
to[R, l=$R_G$] (2,3)
to[C, l=$10nF$] (5,3)
(5,0) to[R, l=$10k\Omega$, v=$V_{out}$] (5,3)
(5,0)--(0,0)
(0,4.5) node[] {Générateur};
\draw[dotted] (-2,-1)--(-2,4)--(2,4)--(2,-1)--(-2,-1);
\end{circuitikz}

```

## 2.4 RLC - Out on C

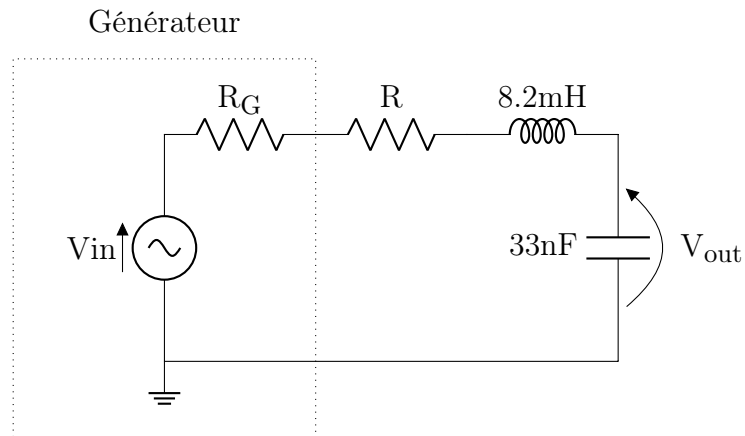


```

\begin{circuitikz} \draw
(0,0) node[ground]{}
to[american voltage source, v=$V_{in}$, invert] (0,3)
to[R, l=$R$] (3,3)
to[L, l=$L$] (6,3)
(6,0) to[C, l=$C$, v=$V_{out}$] (6,3)
(6,0)--(0,0);
\end{circuitikz}

```

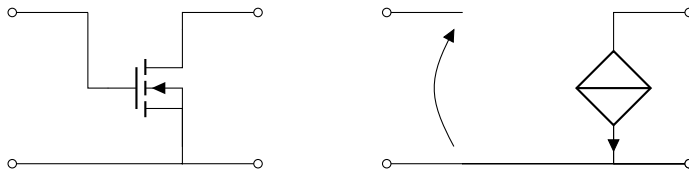
## 2.5 RLC with generator - Out on C



```
\begin{circuitikz} \draw
(0,0) node[ground]{}
to[sinusoidal voltage source, v=$V_{in}$] (0,3)
to[R, l=$R_G$] (2,3)
to[R, l=$R$] (4,3)
to[L, l=$8.2mH$] (6,3)
(6,0) to[C, l=$33nF$, v=$V_{out}$] (6,3)
(6,0)--(0,0)
(0,4.5) node[] {Générateur};
\draw[dotted](-2,-1)--(-2,4)--(2,4)--(2,-1)--(-2,-1);
\end{circuitikz}
```

## 3 Transistors

### 3.1 Alone



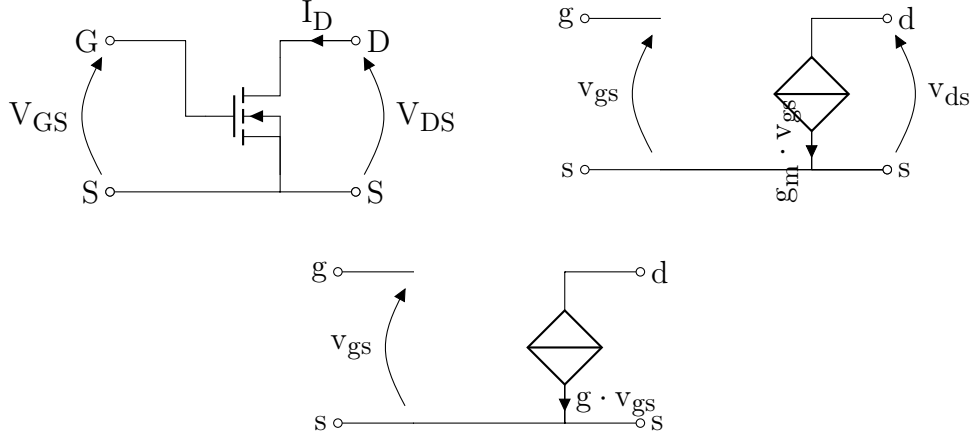
```
\begin{circuitikz} \draw
(2.25, 1) node[nfet] (mos) {}
(mos.D) -- (2.25, 2) to [short, -o] (3.25, 2) node[anchor=west] {}
↪ %D
(mos.S) -- (2.25, 0) to [short, -o] (3.25, 0) node[anchor=west] {}
↪ %S
(mos.B) -- (mos.S)
(2.25,0) to [short, -o] (0,0) node[anchor=east] {} %S
(0,2) node[anchor=east]{}[short, o-] to (1,2) %G
(1,2) -- (1,1) -- (mos.G)
;
\end{circuitikz}\hspace*{1cm}
\begin{circuitikz}\draw
(0,0) node[anchor=east] {} %g
to [short, o-] (1,0)
to [open, v<={~}] (1,-2)
to [short, -o] (4,-2)
to [short, -o] (0,-2) node[anchor=east] {} %s
(3,0) to [cI, i={~}] (3,-2)
(3,-2) to [short, -o] (4,-2) node[anchor=west] {} %s
(3,0) to [short, -o] (4,0)
```

```

to node[anchor=west] {} (4,0) %d
;\end{circuitikz}

```

### 3.2 Alone with voltage and current



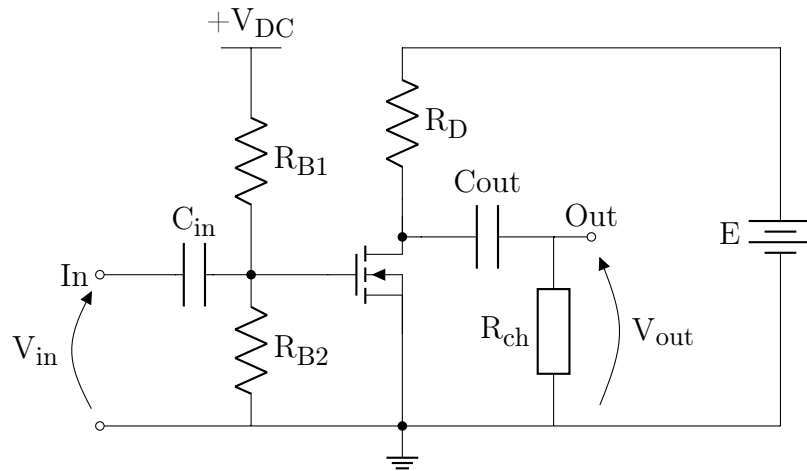
```

\begin{circuitikz} \draw
(2.25, 1) node[nfet] (mos) {}
(mos.D) -- (2.25, 2) to [short, -o, i<=I_D$(3.25, 2) node[anchor=west] {D}
\to %D
(mos.S) -- (2.25, 0) to [short, -o](3.25, 0) node[anchor=west] {S}
\to %S
(mos.B) -- (mos.S)
(2.25,0) to [short, -o](0,0) node[anchor=west] {S} %S
(0,2) node[anchor=west]{G}[short, o-] to (1,2) %G
(1,2) -- (1,1) -- (mos.G)
(0,0) [open,v^>=V_{GS}] to (0,2)
(3.25,0) [open,v>=V_{DS}] to (3.25,2)
;\end{circuitikz}\hspace*{1cm}
\begin{circuitikz}\draw
(0,0) node[anchor=west] {g} %g
to [short, o-] (1,0)
to [open, v<=V_{gs}] (1,-2)
to [short, -o] (4,-2)
to [short, -o] (0,-2) node[anchor=west] {s} %s
(3,0) to [cI, i_=\rotatebox{90}{g_m\cdot V_{gs}}] (3,-2)
(3,-2) to [short, -o] (4,-2) node[anchor=west] {s} %s
(3,0) to [short, -o] (4,0)
to node[anchor=west] {d} (4,0) %d
(4.0,-2) [open,v>=V_{ds}] to (4.0,0)
;\end{circuitikz}

\begin{circuitikz}\draw
(0,0) node[anchor=west] {g}
to [short, o-] (1,0)
to [open, v<=V_{gs}] (1,-2)
to [short, -o] (0,-2)
to (0,-2) node[anchor=west] {s}
(3,0) to [cI=$ g \cdot V_{gs}] (3,-2)
(3,-2) to [short, -o] (4,-2) node[anchor=west] {s}
(3,0) to [short, -o] (4,0)
to node[anchor=west] {d} (4,0)
(1,-2) -- (3,-2)
;\end{circuitikz}

```

### 3.3 Full common source



```

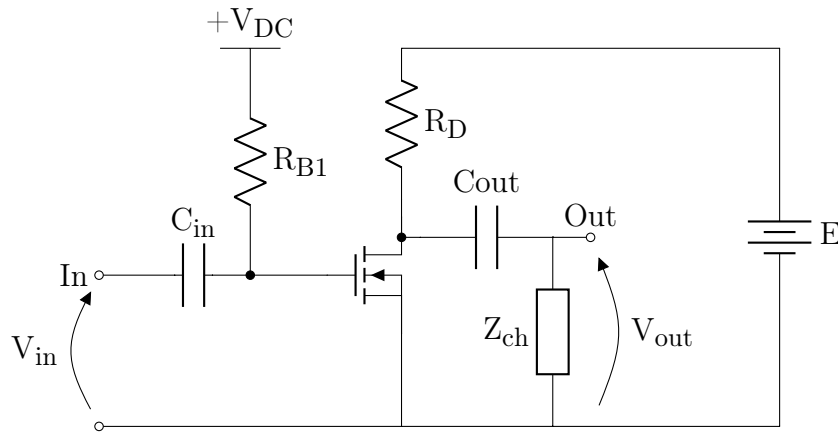
\begin{circuitikz}[scale=1]\draw
(0,1) to [short,o-] (9,1)
(4,6) to [short] (9,6)
(0,3) node[anchor=east] {In} to [short,o-] (1,3)
(0,3) node[anchor=south]{} to [open, v_<=$V_{in}$] (0,1)
(1,3) to [C=$C_{in}$] (1.5,3)
(1.5,3) to [short,-*] (2,3) node[anchor=south west]{}

(2,6) node[anchor=south ] (alim) {$+V_{DC}$}
(1.6,6) -- (2.4,6) %bar under the label
(2,3) to [R, l_=$R_{B1}$] (2,6)
(2,3) to [R=$R_{B2}$] (2,1)
(4,3) node[nfet] (mos) {}
(mos.G) to [short] (2,3)
(mos.D) to (4,4) to [R, l_=$R_D$] (4, 6)
(mos.D) to [short,-*](4,3.5) to [short] (4.25,3.5)
(mos.S) to [short] (4,1)% to [short, -o](2,0) node[anchor=west] {S}
(mos.S) -- (mos.B) %source to bulk connection

(4.25,3.5) node[anchor=south]{} to [C, l^=$C_{out}$] (6,3.5) to
↪ [short](6,3.5)node[anchor=south]{} to [short,-o](6.5,3.5)node [anchor=south]
↪ {Out}
(6,3.5) to [generic, l_=$R_{ch}$] (6,1)
(6.5,3.5) to [open,v^<=$V_{out}$] (6.5,1)
(9,6) to [battery, l_=$E$] (9,1)
(4,1) node[circ]{}
(4,1) node[ground]{}
;\end{circuitikz}

```

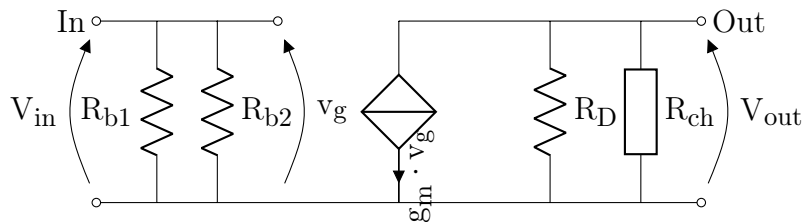
### 3.4 Common source - Direct polarisation



```
\begin{circuitikz}[scale=1]\draw
(0,1) to [short,o-] (9,1)
(4,6) to [short] (9,6)
(0,3) node[anchor=east] {In} to [short,o-] (1,3)
(0,3) to [open, v_<=$V_{in}$] (0,1)
(1,3) to [C=$C_{in}$] (1.5,3)
(1.5,3) to [short,-*] (2,3)
(2,6) node[anchor=south] (alim) {+$V_{DC}$}
(1.6,6) -- (2.4,6) %bar under the label
(2,3) to [R, l_=$R_{B1}$] (2,6)
(4,3) node[nfet] (mos) {}
(mos.G) to [short] (2,3)
(mos.D) to (4,4) to [R, l_=$R_D$] (4, 6)
(mos.D) to [short,-*](4,3.5) to [short] (4.25,3.5)
(mos.S) to [short] (4,1)% to [short, -o](2,0) node[anchor=west] {S}
(mos.S) -- (mos.B) %source to bulk connection

(4.25,3.5) to [C, l_=$C_{out}$] (6,3.5) to [short](6,3.5) to [short,-o](6.5,3.5)node
↪ [anchor=south] {Out}
(6,3.5) to [generic, l_=$Z_{ch}$] (6,1)
(6.5,3.5) to [open,v_<=$V_{out}$] (6.5,1)
(9,6) to [battery, l=$E$] (9,1)
;\end{circuitikz}
```

### 3.5 Common source - small signal



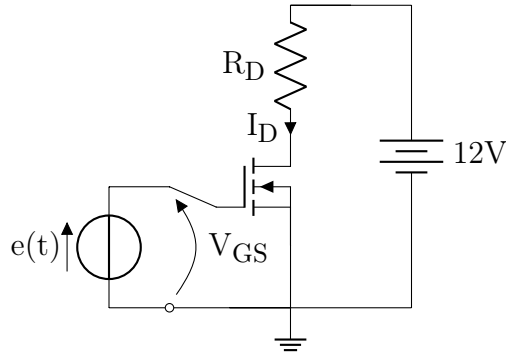
```
\begin{circuitikz}[scale=0.8]\draw
(1,0) to [short,o-o] (11,0)
(1,3) node[anchor=east] {In} to [short,o-] (1,3)
(1,3) to [open, v_<=$V_{in}$] (1,0)
(1,3) to [short] (3,3)
(2,3) to [R, l_=$R_{b1}$] (2,0)
(3,3) to [R=$R_{b2}$] (3,0)
(3,3) to [short,-o](4,3) node [anchor=west] {}
(4,3) to [open, v_<=$v_{g}$] (4,0)
(6,3) to [cI=$\rotatebox{90}{$g_m \cdot v_{g}$}] (6,0)
```

```

(8.5,0) to [R,l= $R_D$ ] (8.5,3)
(10,3) to [generic, l= $R_{ch}$ ] (10,0)
(6,3) to [short,-o] (11,3) node [anchor=west] {Out}
(11,3) to [open, v^<= $V_{out}$ ] (11,0)
;\end{circuitikz}

```

### 3.6 Common source simple

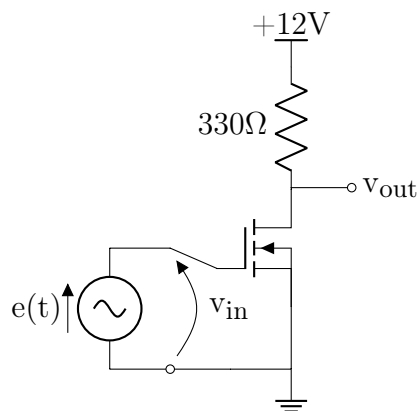


```

\tikzset{tripoles/mos style/arrows}
\begin{circuitikz}[scale=0.8]\draw
(0,0) to [V= $e(t)$ ] (0,2)
(0,2) to [short] (1,2)
(0,0) to (1,0)
(1,2) to [open, v^<= $V_{GS}$ ] (1,0)
(1,0) to [short, o-] (2,0)
(3,2) node[nigfete ] (mos) {}
(3,0) to [short] (mos.S)
(1,2) to [short] (mos.G)
(2,0) to (3,0)
(mos.D) to [short, i<= $I_D$ ] (3,3)
(3,3) to [R,l= $R_D$ ] (3,5)
(3,5) to (4,5)
(2,0) -- (5,0)
(5,5) -- (3,5)
(5,5) to [battery, l= $12V$ ] (5,0)
(3,0) node[ground] {}
;\end{circuitikz}

```

### 3.7 Common source simple with $v_{out}$



```

\begin{circuitikz}[scale=0.8] \draw
(0,0) to [sV= $e(t)$ ] (0,2)

```

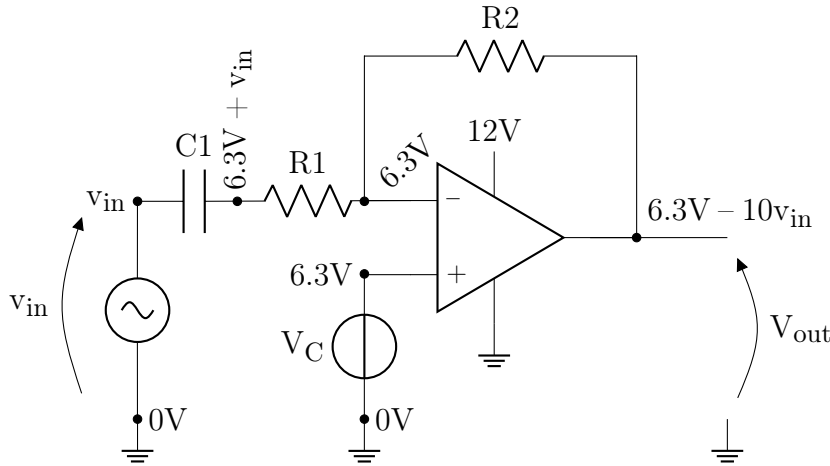
```

(0,2) to [short] (1,2)
(0,0) to (1,0)
(1,2) to [open, v^<=$v_{in}$] (1,0)
(1,0) to [short, o-] (2,0)
(3,2) node[nigfete ] (mos) {}
(mos.S) to [short] (3,0)
(1,2) to [short] (mos.G)
(2,0) to (3,0)
(mos.D) to [short] (3,3) %, i<=$I_D$
(3,3) to [R, l=$330\ohm$] (3,5)
(3,3) to [short, -o] (4,3)
(4,3) node[anchor=west] {$v_{out}$}
(3,5) node[rground, yscale=-1] (alim) {}
(3,5.7) node {+12V}
(3,0) node[ground] {}
;\end{circuitikz}

```

## 4 Operational amplifiers

### 4.1 Inverter with voltage and buffered offset

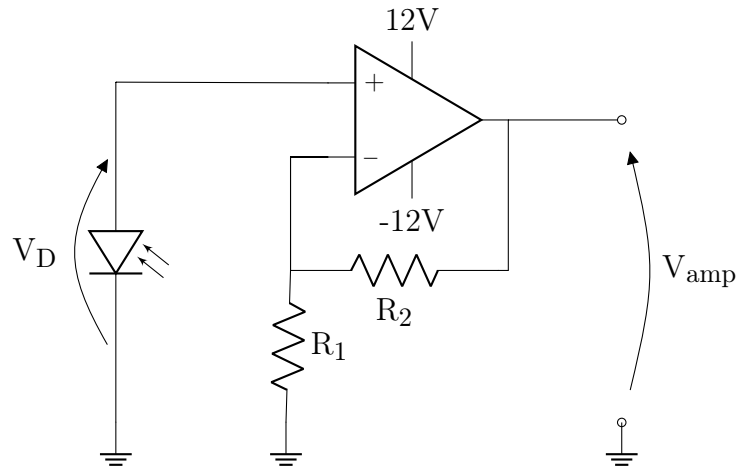


```

\begin{circuitikz} [scale=1.2]\draw
(0,0) node[op amp] (opamp) {}
(opamp.down) ++ (0,-0.5) node[ground]{} -- (opamp.down)
(opamp.up) ++ (0,.5) node[above] {12V} -- (opamp.up)
(opamp.-) -| (-1.5,2) to [R, l=$R2$] (1.5,2) |- (opamp.out)
(opamp.+) -| (-1.5,-0.4) to [european voltage source, l_=$V_{C}$,-*] (-1.5,-2)
-> node[ground] {}
(-4,-2) node[ground] {} to [sV,*-] (-4,0.4) |- ++(0.5,0) to [C,l=$C1$]
-> ++(0.25,0) to [R,l=$R1$] (opamp.-)
(-4,-2) node[anchor=west] {$0V$}
(-1.5,-2) node[anchor=west] {$0V$}
(-2.9,0.4) node[circ]{}
(-2.9,0.4) node[anchor=south]{\rotatebox{90}{$6.3V+v_{in}$}}
(-1.5,0.4) node[circ]{}
(-1.5,0.4) node[anchor=south west]{\rotatebox{42}{$6.3V$}}
(-1.5,-0.4) node[circ]{}
(-1.5,-0.4) node[anchor=east]{$6.3V$}
(1.5,0) node[circ]{}
(1.5,0) node[anchor=south west]{$6.3V-10v_{in}$}
(opamp.out) to (2.5,0)
(2.5,-2) node[ground] {} to [open, v>=$V_{out}$] (2.5,0)
(-4.5,-2) to [open, v^>=$v_{in}$] (-4.5,0.5)
(-4,0.4) node[anchor=east] {$v_{in}$}
;\end{circuitikz}

```

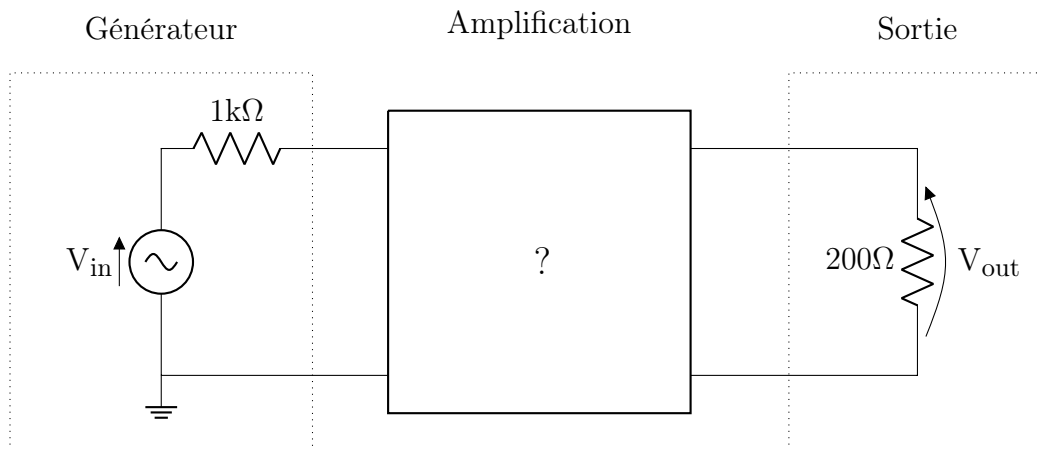




```

\begin{circuitikz}\draw
(0,4.5) to [photodiode,v_<=$V_D$, ] (0,0) node [ground] {}
(4,4) node[op amp, yscale=-1] (opamp) {}
(opamp.down) ++ (0,+0.5) node[above] {12V} -- (opamp.down)
(opamp.up) ++ (0,-0.5) node[below] {-12V} -- (opamp.up)
(opamp.-) -| ++(-0.5,-1.5) to [R, l_=$R_2$] ++(2.75,0) -| (opamp.out)
(opamp.-) -| ++(-0.5,-1.5) to [R, l_=$R_1$] (2.25,0) node[ground] {}
(opamp.+) to [short](0,4.5)
(opamp.out) to [short] ++(1.5,0) node (A) {}
to [open, v^<=$V_{amp}$, o-o] ++(0,-4) node [ground]{}
;
\end{circuitikz}

```



```

\begin{circuitikz}
\draw
(0,0) node[ground]{}
to[sinusoidal voltage source, v=$V_{in}$] (0,3)
to[R, l=\si{1}{k\ohm}] (2,3)
to[short] (3,3)
to[open] (7,3)
to[short] (10,3)
to[R, l=\si{200}{\ohm}, v^<=$ V_{out}$] (10,0)
to[short] (7,0)
to[open] (3,0)
to[short] (0,0)
(0,4.3) node[anchor=south] {Générateur}
(5,4.3) node[anchor=south] {Amplification}
(10,4.3) node[anchor=south] {Sortie}
(5,1.2) node[anchor=south] {\large ?}
;

```

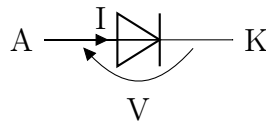
```

\draw[thick] (3, 3.5) -- (7, 3.5) -- (7, -0.5) -- (3, -0.5) -- (3, 3.5);
\draw[dotted] (-2,-1)--(-2,4)--(2,4)--(2,-1)--(-2,-1);
\draw[dotted] (8.3,-1)--(8.3,4)--(11.7,4)--(11.7,-1)--(8.3,-1);
\end{circuitikz}

```

## 5 Diodes

### 5.1 Alone

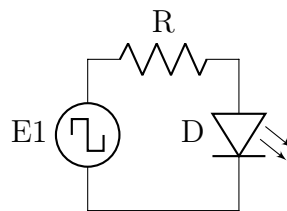


```

\begin{circuitikz}\draw
(0,0) node[anchor=east] {A} to [short,i>~=$I$] (1.5,0)
(0,0) to [Do, v<~=$V$] (2.5,0) node [anchor=west]{K}
;\end{circuitikz}

```

### 5.2 Pulsed LED

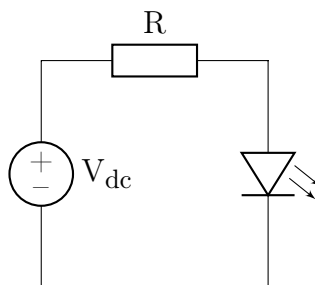


```

\begin{circuitikz}\draw
(0,0) to [square voltage source, l=$E1$] (0,2) to [R, l=$R$] (2,2) to [led,
<- l=$D$] (2,0) --(0,0)
;
\end{circuitikz}

```

### 5.3 LED

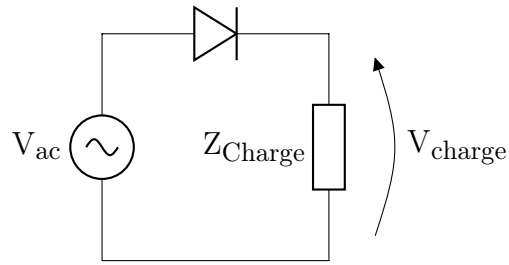


```

\begin{circuitikz}\draw
(0,3) to [american voltage source, l=$V_{dc}$] (0,0)
(0,3) to [european resistor, l~=$R$] (3,3)
to [leDo] (3,0) -- (0,0)
;\end{circuitikz}

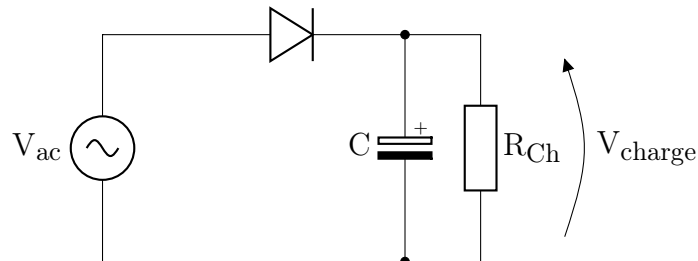
```

## 5.4 Load



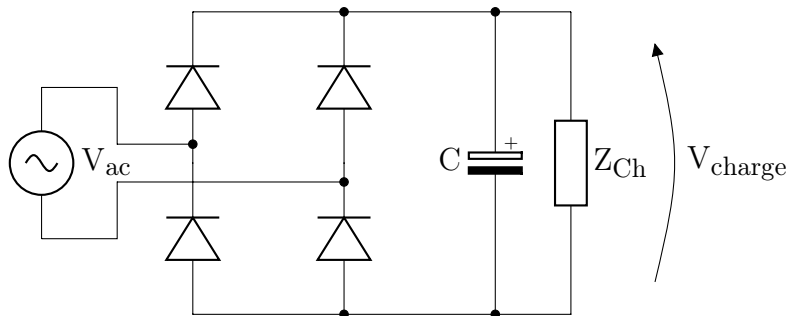
```
\begin{circuitikz}\draw
  (0,0) to [sV, l=$V_{ac}$] (0,3)
  to [Do] (3,3)
  to [european resistor,l=$Z_{Charge}$] (3,0) to (0,0)
  (3.5,3) to [open, v^<=$V_{charge}$] (3.5,0)
;\end{circuitikz}
```

## 5.5 Load and C in parallel



```
\begin{circuitikz}\draw
  (0,0) to [sV, l=$V_{ac}$] (0,3)
  to [Do] (5,3)
  to [european resistor,l=$R_{Ch}$] (5,0) to (0,0)
  (4,3) to [eC,l=$C$, *-] (4,0)
  (6,3) to [open, v^<=$V_{charge}$] (6,0)
;\end{circuitikz}
```

## 5.6 Full-wave rectifier with C and load



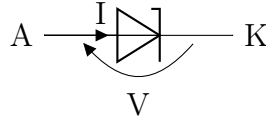
```
\begin{circuitikz}\draw
  (-2,1) to [sV, l=$V_{ac}$] (-2,3)
  (-2,1) to (-1,1) to (-1,1.75) to [short,-*] (2,1.75)
  (-2,3) to (-1,3) to (-1,2.25) to [short,-*] (0,2.25)
  (0,0) to [Do] (0,2) to [Do](0,4)
  (2,0) to [Do,-*] (2,2) to [Do, -*] (2,4)
  (0,4) to [short] (5,4)
  (0,0) to [short] (2,0)
```

```

(5,4) to [european resistor,l=$Z_{Ch}$] (5,0) to (2,0)
(4,4) to [eC,l_=$C$, *-*] (4,0)
(6,4) to [open, v^<=$V_{charge}$] (6,0)
;\end{circuitikz}

```

## 5.7 Zener alone

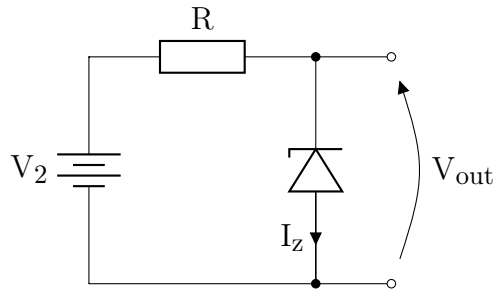


```

\begin{circuitikz}\draw
(0,0) node[anchor=east] {A} to [short,i^>=$I$] (1.5,0)
(0,0) to [zDo, v^<=$V$] (2.5,0) node [anchor=west]{K}
;\end{circuitikz}

```

## 5.8 Zener - DC source

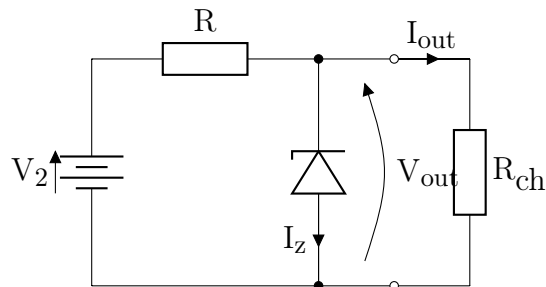


```

\begin{circuitikz}\draw
(0,0) to [battery, invert, l=$V_{2}$] (0,3)
to [european resistor,l=$R$] (3,3)
(3,0) to [zDo, i^<=$I_z$] (3,3)
(3,0) to (0,0)
(3,0) to [short,*-o] (4,0)
(3,3) to [short,*-o] (4,3)
(4,3) to [open,v^<=$V_{out}$\equiv -V(Fig\ref{fig:zenerconv})$] (4,0)
;\end{circuitikz}

```

## 5.9 Zener - DC source and load



```

\begin{circuitikz}\draw
(0,3) to [battery, v_<=$V_{2}$] (0,0)
(0,3) to [european resistor,l=$R$] (3,3)
(3,0) to [zDo, i^<=$I_z$] (3,3)
(3,0) to (0,0)

```

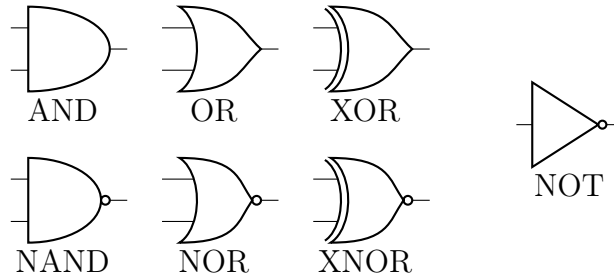
```

(3,0) to [short,*-o] (4,0) to (5,0)
(3,3) to [short,*-o] (4,3) to [short, i=$I_{out}$] (5,3)
(5,3) to [european resistor,l=$R_{\mbox{ch}}$] (5,0)
(3.5,3) to [open,v^<=$V_{out}$] (3.5,0)
;\end{circuitikz}

```

## 6 Logic

### 6.1 Gates



```

\begin{circuitikz} \draw
(0,0) node [american nand port] {}
(-0.7,-0.8) node {NAND}

(2,0) node [american nor port] {}
(2-0.7,-0.8) node {NOR}

(4,0) node [american xnor port] {}
(4-0.7,-0.8) node {XNOR}

(0,2) node [american and port] {}
(-0.7,2-0.8) node {AND}

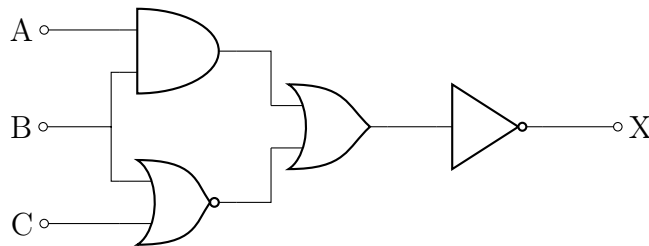
(2,2) node [american or port] {}
(2-0.7,2-0.8) node {OR}

(4,2) node [american xor port] {}
(4-0.7,2-0.8) node {XOR}

(6,1) node [american not port] {}
(6.7-0.7,1-0.8) node {NOT}
;\end{circuitikz}

```

### 6.2 Circuit 1



```

\begin{circuitikz} \draw
(0,0) node [american nor port] (nor) {}
(nor.in 2) -- ++(-1,0) node [ocirc] {} node [anchor=east] {C}
(nor.in 1) -| (-1.5,1)
(0,2) node [american and port] (and){}
(and.in 2) -| (-1.5,1) to [short, -o] (-2.4,1) node [anchor=east] {B}

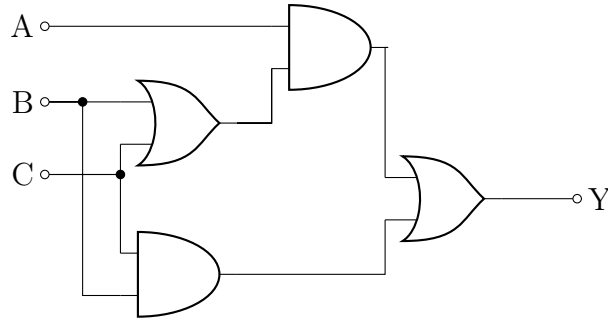
```

```

(and.in 1)      -- ++(-1,0) node [ocirc] {} node [anchor=east] {A}
(2,1) node [american or port] (or){}
(and.out) -| (or.in 1)
(nor.out) -| (or.in 2)
(3.5,1) node [american not port] (not){}
(or.out) -- (not.in)
(not.out) -- ++(1,0) node [ocirc] {} node [anchor=west] {X}
;\end{circuitikz}

```

## 6.3 Voter

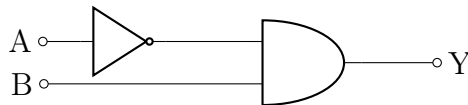


```

\begin{circuitikz} \draw
(0,0) node [american and port] (and1) {}
(and1.in 2) -- ++(-0.5,0) |- node [circ] {} ++(-0.5,2.56) node [ocirc] (B) {}
→ node [anchor=east] {B}
(0,2) node [american or port] (or){}
(or.in 1) -- ++(-0.5,0) |- (B)
(or.in 2) |- node [circ] {} ++(-1,-0.4) node [ocirc] (C) {} node [anchor=east]
→ {C}
(and1.in 1) |- (C)
(2,3) node [american and port] (and2) {}
(or.out) -| (and2.in 2)
(and2.in 1) -- ++(-3,0) node [ocirc] (A) {} node [anchor=east] {A}
(or.out) -| (and2.in 2)
(3.5,1) node [american or port] (and3){}
(and2.out) -| (and3.in 1)
(and1.out) -| (and3.in 2)
(and3.out) -- ++(1,0) node [ocirc] {} node [anchor=west] {Y}
;\end{circuitikz}

```

## 6.4 Circuit 2

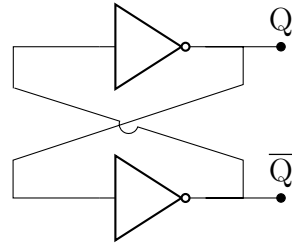
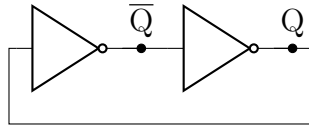


```

\begin{circuitikz} \draw
(0,0.72) node [american and port] (and1) {}
(-3,1) node [american not port, scale=0.8] (not){}
(and1.in 1) -| (not.out)
(not.in) |- ++(-0.5,0) node [ocirc] (A) {} node [anchor=east] {A}
(and1.in 2) |- ++(-2.66,0) node [ocirc] (B) {} node [anchor=east] {B}
(and1.out) -- ++(1,0) node [ocirc] (Y) {} node [anchor=west] {Y}
;\end{circuitikz}

```

## 6.5 Bistable



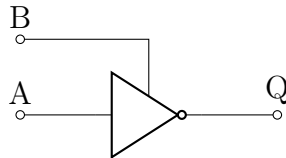
```
\begin{circuitikz} \draw
  (0,0) node [american not port] (not3) {}
  (2,0) node [american not port] (not4) {}
  (not3.out) -- (not4.in)
  (not4.out) -- ++(0.5,0) |- ++(-4,-1) |- (not3.in)
  (not3.out) |- ++(0.25,0) node [circ] () {} node [anchor=south] {\overline{Q}}
  (not4.out) |- ++(0.25,0) node [circ] () {} node [anchor=south] {Q}

  (8,1) node [american not port] (not1) {}
  (8,-1) node [american not port] (not2) {}
  (not1.out) ++(0.5,-0.5) coordinate (a-a) %coords of the crossing wire
  (not2.in) ++(-1,0.5) coordinate (a-b)

  (not1.in)++(-1.27,-0.5) node (in) {} % end of the wire with kinky bump
  (not2.out)-| ++(0.5,0.5) to [kinky cross=(a-a)--(a-b), kinky crosses=left] (in)
  (not1.in)-| ++(-1.14,-0.55)
  (not2.out) -- ++(1,0) node [circ] () {} node [anchor=south] {\overline{Q}}

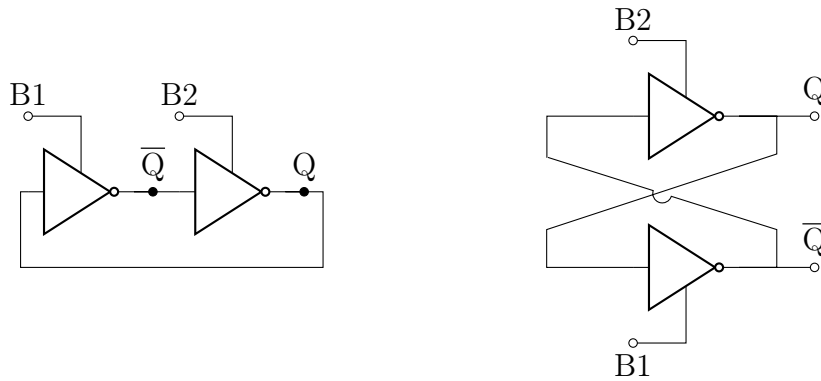
  (not1.out) -| ++(0.5,-0.5) -- ++(-3.043,-1) |- (not2.in)
  (not1.out) -- ++(1,0) node [circ] () {} node [anchor=south] {Q}
;\end{circuitikz}
```

## 6.6 Enable



```
\begin{circuitikz} \draw
  (0,0) node [american not port] (not1) {}
  (not1)+(0,.25) |- ++(-1.7,1) node [ocirc] () {} node [anchor=south] {B}
  (not1.in) -- ++(-1,0) node [ocirc] () {} node [anchor=south] {A}
  (not1.out) -- ++(1,0) node [ocirc] () {} node [anchor=south] {Q}
;\end{circuitikz}
```

## 6.7 Bistable with enable



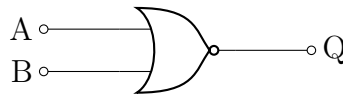
```
\begin{circuitikz} \draw
  (0,0) node [american not port] (not3) {}
  (not3)+(0,.25) |- ++(-0.7,1) node [ocirc] () {} node [anchor=south] {$B1$}
  (2,0) node [american not port] (not4) {}
  (not4)+(0,.25) |- ++(-0.7,1) node [ocirc] () {} node [anchor=south] {$B2$}
  (not3.out) -- (not4.in)
  (not4.out) -- ++(0.5,0) |- ++(-4,-1) |- (not3.in)
  (not3.out) |- ++(0.25,0) node [circ] () {} node [anchor=south] {$\overline{Q}$}
  (not4.out) |- ++(0.25,0) node [circ] () {} node [anchor=south] {$Q$}

  (8,1) node [american not port] (not1) {}
  (not1)+(0,0.25) |- ++(-0.7,1) node [ocirc] () {} node [anchor=south] {$B2$}
  (8,-1) node [american not port] (not2) {}
  (not2)+(0,-0.25) |- ++(-0.7,-1) node [ocirc] () {} node [anchor=north] {$B1$}
  (not1.out) ++(0.5,-0.5) coordinate (a-a) %coords of the crossing wire
  (not2.in) ++(-1,0.5) coordinate (a-b)

  (not1.in)++(-1.27,-0.5) node (in) {} % end of the wire with kinky bump
  (not2.out)-| ++(0.5,0.5) to [kinky cross=(a-a)--(a-b), kinky crosses=left] (in)
  (not1.in)-| ++(-1.14,-0.55)
  (not2.out) -- ++(1,0) node [ocirc] () {} node [anchor=south] {$\overline{Q}$}

  (not1.out) -| ++(0.5,-0.5) -- ++(-3.043,-1) |- (not2.in)
  (not1.out) -- ++(1,0) node [ocirc] () {} node [anchor=south] {$Q$}
;\end{circuitikz}
```

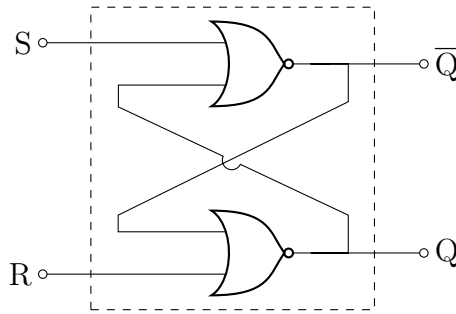
## 6.8 NOR



```
\begin{circuitikz} \draw
  (0,0) node [american nor port] (nor) {}
  (nor.in 1) -- ++(-1,0) node [ocirc] () {} node [anchor=west] {$A$}
  (nor.in 2) -- ++(-1,0) node [ocirc] () {} node [anchor=west] {$B$}
  (nor.out) -- ++(1,0) node [ocirc] () {} node [anchor=west] {$Q$}
;\end{circuitikz}
```



## 6.9 SR using NOR



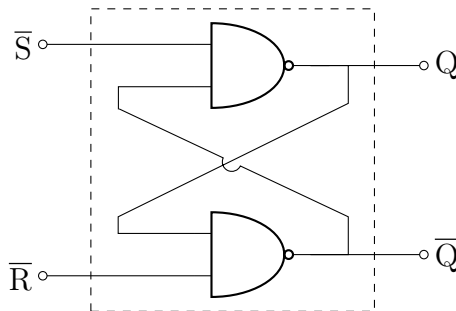
```
\begin{circuitikz} \draw
  (0,1) node [american nor port] (nor1) {}
  (0,-1.5) node [american nor port] (nor2) {}
  (nor1.out) ++(0.5,-0.5) coordinate (a-a) %coords of the crossing wire
  (nor2.in 2) ++(-1.5,0.5) coordinate (a-b)

  (nor1.in 2)++(-1.135,-0.225) node (in) {} % end of the wire with kinky bump
  (nor2.out)-| ++(0.5,0.5) to [kinky cross=(a-a)--(a-b), kinky crosses=left] (in)
  (nor1.in 2)-| ++(-1,-0.3)
  (nor1.out) -- ++(1.5,0) node [ocirc] () {} node [anchor=west]  $\overline{Q}$ 

  (nor1.out) -| ++(0.5,-0.5) -- ++(-3.043,-1.5) |- (nor2.in 1)
  (nor2.out) -- ++(1.5,0) node [ocirc] () {} node [anchor=west]  $Q$ 
  (nor1.out) |- ++(0.25,0)

  (nor1.in 1) -- ++(-2,0) node [ocirc] () {} node [anchor=east]  $\overline{S}$ 
  (nor2.in 2) -- ++(-2,0) node [ocirc] () {} node [anchor=east]  $\overline{R}$ 
;\draw [dashed](-2.75,-2.25) rectangle (1,1.75);
\end{circuitikz}
```

## 6.10 SR using NAND



```
\begin{circuitikz} \draw
  (0,1) node [american nand port] (nor1) {}
  (0,-1.5) node [american nand port] (nor2) {}
  (nor1.out) ++(0.5,-0.5) coordinate (a-a) %coords of the crossing wire
  (nor2.in 2) ++(-1.5,0.5) coordinate (a-b)

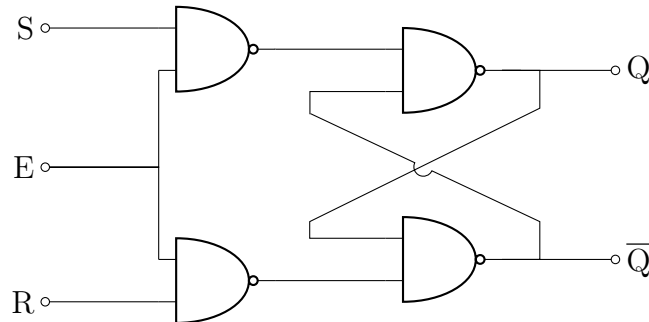
  (nor1.in 2)++(-1.135,-0.225) node (in) {} % end of the wire with kinky bump
  (nor2.out)-| ++(0.5,0.5) to [kinky cross=(a-a)--(a-b), kinky crosses=left] (in)
  (nor1.in 2)-| ++(-1,-0.3)
  (nor1.out) -- ++(1.5,0) node [ocirc] () {} node [anchor=west]  $\overline{Q}$ 

  (nor1.out) -| ++(0.5,-0.5) -- ++(-3.043,-1.5) |- (nor2.in 1)
  (nor2.out) -- ++(1.5,0) node [ocirc] () {} node [anchor=west]  $\overline{Q}$ 
  (nor1.out) |- ++(0.25,0)

  (nor1.in 1) -- ++(-2,0) node [ocirc] () {} node [anchor=east]  $\overline{S}$ 
  (nor2.in 2) -- ++(-2,0) node [ocirc] () {} node [anchor=east]  $\overline{R}$ 
;\draw [dashed](-2.75,-2.25) rectangle (1,1.75);
\end{circuitikz}
```

```
;
\draw [dashed](-2.75,-2.25) rectangle (1,1.75);
\end{circuitikz}
```

## 6.11 SR with NAND and enable



```
\begin{circuitikz} \draw
(0,1.28) node [american nand port] (nand1) {}
(0,-1.5-0.28) node [american nand port] (nand2) {}

(nand1.in 1) -- ++(-1.5,0) node [ocirc] () {} node [anchor=east] {$S$}
(nand2.in 2) -- ++(-1.5,0) node [ocirc] () {} node [anchor=east] {$R$}

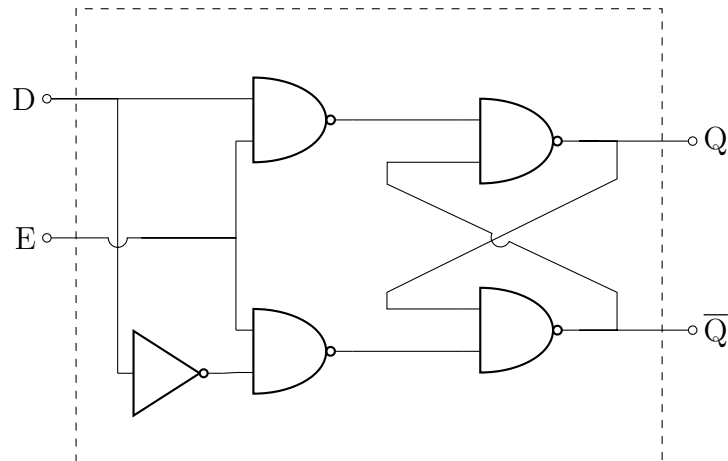
(nand1.in 2) |- ++(-1.5,-1.28) coordinate (dot) node [ocirc] () {} node [anchor=east] {$E$}
(nand2.in 1) |- (dot)

(3,1) node [american nand port] (nor1) {}
(3,-1.5) node [american nand port] (nor2) {}
(nor1.out) ++(0.5,-0.5) coordinate (a-a) %coords of the crossing wire
(nor2.in 2) ++(-1.5,0.5) coordinate (a-b)

(nor1.in 2)++(-1.135,-0.225) node (in) {} % end of the wire with kinky bump
(nor2.out)-| ++(0.5,0.5) to [kinky cross=(a-a)--(a-b), kinky crosses=left] (in)
(nor1.in 2)-| ++(-1,-0.3)
(nor1.out) -- ++(1.5,0) node [ocirc] () {} node [anchor=west] {$Q$}

(nor1.out) -| ++(0.5,-0.5) -- ++(-3.043,-1.5) |- (nor2.in 1)
(nor2.out) -- ++(1.5,0) node [ocirc] () {} node [anchor=west] {$\overline{Q}$}
(nor1.out) |- ++(0.25,0)
(nor1.in 1) -| (nand1.out)
(nor2.in 2) -| (nand2.out)
;\end{circuitikz}
```

## 6.12 D latch



```
\begin{circuitikz} \draw
  (0,1.28) node [american nand port] (nand1) {}
  (0,-1.5-0.28) node [american nand port] (nand2) {}

  (nand1.in 1) -- ++(-2.5,0) node [ocirc] (D) {} node [anchor=east] {$D$}
  (-2.25,-2.07) node [american not port] (not) {}
  (D) -| (not.in)
  (not.out) -- (nand2.in 2)
  (D)++(0.94,0) coordinate (Dvert) %pour avoir seulement le segment vertical pour calculer
  ↪ l'intersection
  (nand1.in 2) |- ++(-1.25,-1.28) coordinate (dot)
  (dot) to [kinky cross=(Dvert)--(not.in), kinky crosses=left] ++(-1.25,0) node [ocirc] (E) {} node
  ↪ [anchor=east] {$E$}
  (nand2.in 1) |- (dot)

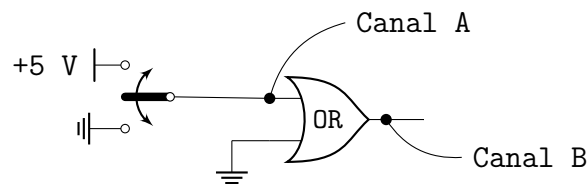
  (3,1) node [american nand port] (nor1) {}
  (3,-1.5) node [american nand port] (nor2) {}
  (nor1.out) ++(0.5,-0.5) coordinate (a-a) %coords of the crossing wire
  (nor2.in 2) ++(-1.5,0.5) coordinate (a-b)

  (nor1.in 2)++(-1.135,-0.225) node (in) {} % end of the wire with kinky bump
  (nor2.out)-| ++(0.5,0.5) to [kinky cross=(a-a)--(a-b), kinky crosses=left] (in)
  (nor1.in 2)-| ++(-1,-0.3)
  (nor1.out) -- ++(1.5,0) node [ocirc] (Q) {} node [anchor=west] {$Q$}

  (nor1.out) -| ++(0.5,-0.5) -- ++(-3.043,-1.5) |- (nor2.in 1)
  (nor2.out) -- ++(1.5,0) node [ocirc] (Qbar) {} node [anchor=west] {$\overline{Q}$}
  (nor1.out) |- ++(0.25,0)
  (nor1.in 1) -| (nand1.out)
  (nor2.in 2) -| (nand2.out)

; \draw [dashed] (-3.5,-3.25) rectangle (4.25,2.75);
\end{circuitikz}
```

## 6.13 OR with switch



```
\begin{circuitikz} \draw
  (0,0) node [american or port] (or) {\small{\texttt{OR}}}
```

```

(-3,0.3) node[cute spdt mid arrow,xscale=-1] (sw) {}

($ (sw.out 1)-(1,0)$) node {\texttt{+5 V}} % 5V label
(sw.out 1) node[rground, yscale=-1, rotate=-90] (alim) {} % 5V alim

(or.in 1) node[circle,fill,inner sep=1.5pt] () {}
(or.in 1) to [bend left] ($ (or.in 1)+(1,1)$) node [right] (chanA) {\texttt{Canal A}}

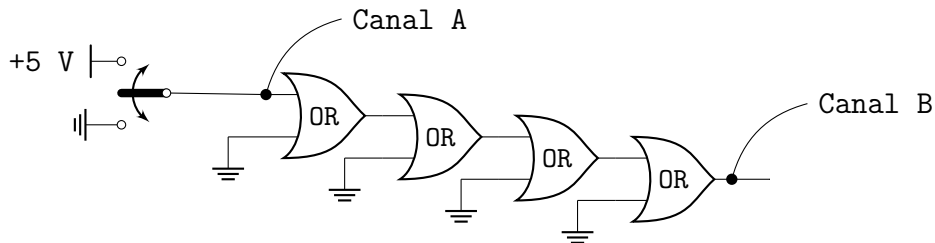
(sw.out 2) node [ground, rotate=-90] {} % ground
(sw.in) -- (or.in 1)

($ (or.in 2)-(0.5,0)$) node [ground] {} to (or.in 2)

(or.out) node[circle,fill, inner sep=1.5pt] () {}
(or.out) to [bend right] ($ (or.out)+(1,-0.5)$) node [right] (chanB) {\texttt{Canal B}}
(or.out) to [short] ($ (or.out)+(0.5,0)$)
;\end{circuitikz}

```

## 6.14 Series of OR with switch



```

\begin{circuitikz} \draw
(0,0) node [american or port] (or) {\small{\texttt{OR}}}

(-3,0.3) node[cute spdt mid arrow,xscale=-1] (sw) {}

($ (sw.out 1)-(1,0)$) node {\texttt{+5 V}} % 5V label
(sw.out 1) node[rground, yscale=-1, rotate=-90] (alim) {} % 5V alim

(or.in 1) node[circle,fill,inner sep=1.5pt] () {}
(or.in 1) to [bend left] ($ (or.in 1)+(1,1)$) node [right] (chanA) {\texttt{Canal A}}

(sw.out 2) node [ground, rotate=-90] {} % ground
(sw.in) -- (or.in 1)

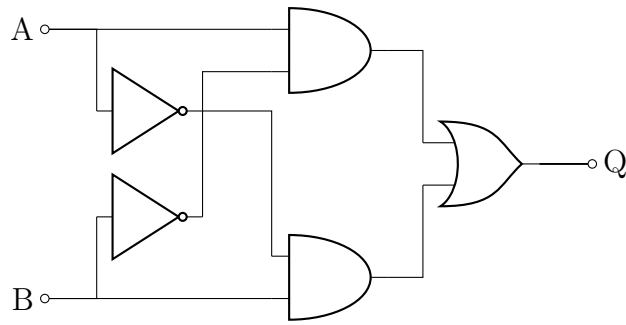
($ (or.in 2)-(0.5,0)$) node [ground] {} to (or.in 2)

(or.out) node [american or port, anchor=in 1] (or2) {\small{\texttt{OR}}}
(or2.out) node [american or port, anchor=in 1] (or3) {\small{\texttt{OR}}}
(or3.out) node [american or port, anchor=in 1] (or4) {\small{\texttt{OR}}}

($ (or2.in 2)-(0.5,0)$) node [ground] {} to (or2.in 2)
($ (or3.in 2)-(0.5,0)$) node [ground] {} to (or3.in 2)
($ (or4.in 2)-(0.5,0)$) node [ground] {} to (or4.in 2)

(or4.out) node[circle,fill, inner sep=1.5pt] () {}
(or4.out) to [bend left] ($ (or4.out)+(1,+1)$) node [right] (chanB) {\texttt{Canal B}}
(or4.out) to [short] ($ (or4.out)+(0.5,0)$)
;\end{circuitikz}

```



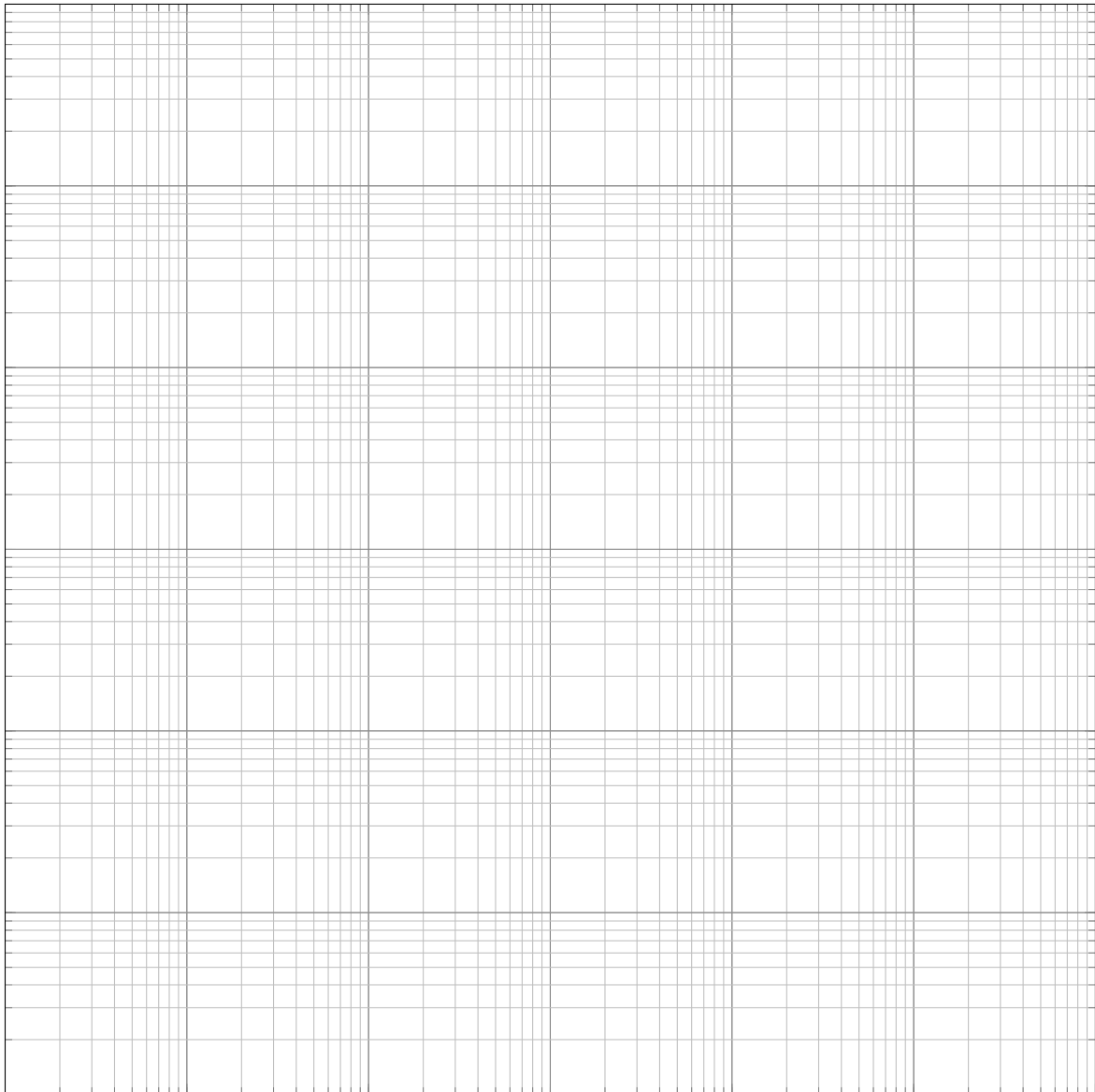
```

\begin{circuitikz}\draw
  (5,0) node [american or port] (or) {}
  (3,1.5) node [american and port] (and1) {}
  (3,-1.5) node [american and port] (and2) {}
  (0,0.7) node [american not port] (not1) {}
  (0,-0.7) node [american not port] (not2) {}
  (and1.in 1) -- ++(-3,0) node [ocirc] (A) {} node [anchor=east] {$A$}
  (and2.in 2) -- ++(-3,0) node [ocirc] (B) {} node [anchor=east] {$B$}
  (or.out) -- ++(0.7,0) node [ocirc] (Q) {} node [anchor=west] {$Q$}
  (A) -| (not1.in)
  (B) -| (not2.in)
  (not1.out) -| (and2.in 1)
  (not2.out) |- (and1.in 2)
  (and1.out) -| (or.in 1)
  (and2.out) -| (or.in 2)
  (or.out) -- (Q)
;
\end{circuitikz}

```

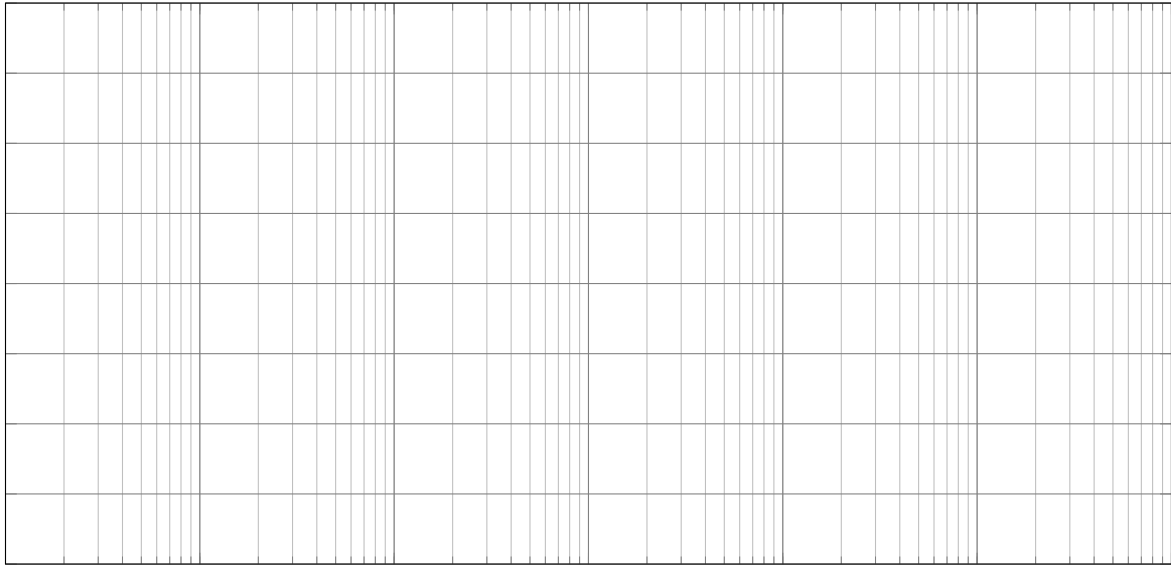
## 7 Graphs

### 7.1 Logarithmic axis



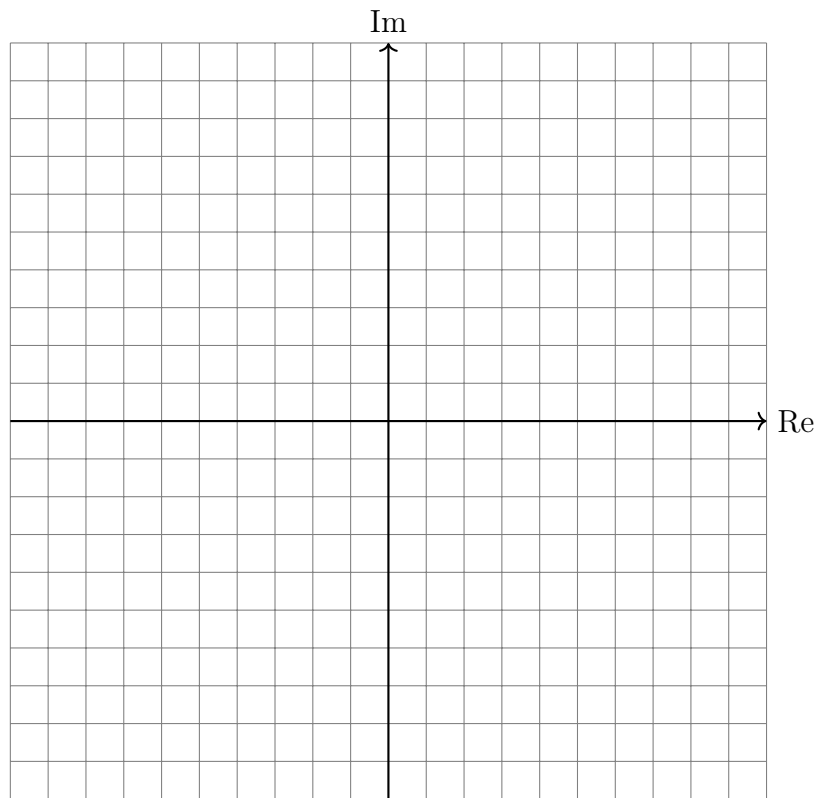
```
\begin{tikzpicture}
  \begin{loglogaxis}[
    xmin=1e-1, xmax=1e5,
    ymin=1e-1, ymax=1e5,
    yticklabels={,,},
    xticklabels={,,},
    grid=both,
    width=17cm,
    height=17cm,
    major grid style={black!50}
  ]
  \end{loglogaxis}
\end{tikzpicture}
```

## 7.2 Semi-logarithmic axis



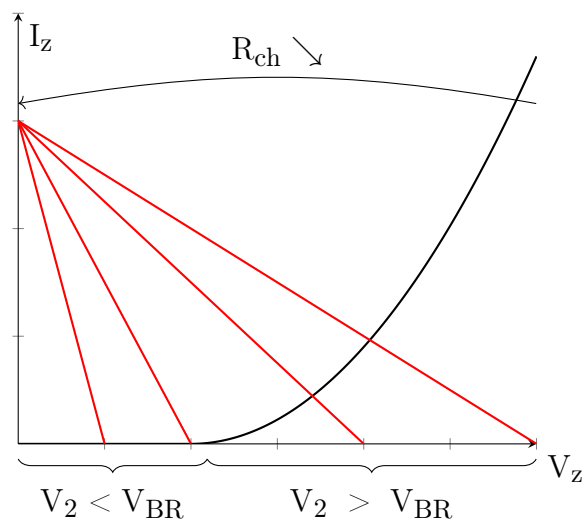
```
\begin{tikzpicture}
  \begin{axis}[
    xmode=log,
    xmin=1e-1, xmax=1e5,
    ymin=1, ymax=9,
    yticklabels={,,},
    xticklabels={,,},
    grid=both,
    width=17cm,
    height=9cm,
    major grid style={black!50}
  ]
  \end{axis}
\end{tikzpicture}
```

### 7.3 Complex plan



```
\begin{tikzpicture}
  \draw[step=0.5cm,gray] (0,0) grid (10,10);
  \draw[thick,->] (0,5) -- (10,5) node[anchor=north west] {};
  \draw[thick,->] (5,0) -- (5,10) node[anchor=north west] {};
  \draw (10,5) node[anchor=west] {Re} ;
  \draw (5,10) node[anchor=south] {Im} ;
\end{tikzpicture}
```

### 7.4 $I_Z(V_Z)$





```

\begin{tikzpicture}
  \begin{axis}[ %title={4Hz Sine Wave},
    % width=7cm,
    % height=5cm,
    axis lines=middle,
    % ymin=-10,
    ymax=4,
    xlabel={V_z},
    xticklabels={},
    yticklabels={},
    % ytick={-10,-8,-6,-5,-4,-3,-2,-1,1,2,3,4,5,6,8,10}
    ylabel={I_z},
    % grid=both,
    % grid style={line width=.1pt, draw=black!60},
    % major grid style={line width=.2pt,draw=black},
    % ultra thick,
    % minor tick num=5,
    % enlargelimits={abs=0.5},
    % axis line style={latex-latex},
    yticklabel style={font=\normalsize,fill=white},
    xlabel style={at={(ticklabel* cs:1)},anchor=north west},
    % ylabel style={at={(ticklabel* cs:1)},anchor=south west},
  ]
  \addplot[
    domain=1:3,
    thick,
    samples=100
  ]
  {0.9*(x-1)^2};
  % \addlegendentry{$V_{in}$}
  \addplot[
    domain=0:1,
    thick,
    samples=100
  ]
  {0};
  \addplot[
    red,
    domain=0:3,
    thick,
    samples=100
  ]
  {-x+3};
  \addplot[
    red,
    domain=0:2,
    thick,
    samples=100
  ]
  {-1.5*x+3};
  \addplot[
    red,
    domain=0:1,
    thick,
    samples=100
  ]
  {-3*x+3};
  \addplot[
    red,
    domain=0:0.5,
    thick,
    samples=100
  ]
  {-6*x+3};
  \end{axis}
  % \draw[dashed] (4.55,0) -- (4.55,5);
  \draw[decorate, decoration={brace, amplitude=5pt}] ([yshift=-0.2cm]2.5,0)--
  \> node[below=0.25cm, text width=2cm, align=center]

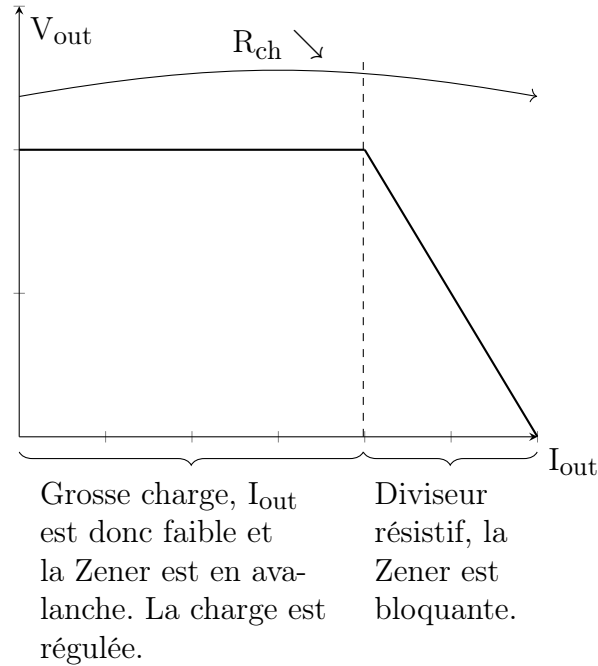
```

```

    {$V_2 < V_{BR}}$)([yshift=-0.2cm]0,0); % Pour avoir une accolade avec la pointe
    ↪ vers le bas, d'abord donner la coordonnee de droite.
    \draw[decorate, decoration={brace, amplitude=5pt}] ([yshift=-0.2cm]6.85,0)--
    ↪ node[below=0.25cm, text width=4cm, align=center]
    {$V_2 > V_{BR}}$)([yshift=-0.2cm]2.5,0); % Pour avoir une accolade avec la pointe
    ↪ vers le bas, d'abord donner la coordonnee de droite.
    \draw [<-] (0,4.5) to [out=10,in=170] node[above]{$R_{ch}$ \searrow$} (6.85,4.5);
% Note that I had to replace the - by "to". Notice how the angles work:
% •
% When the curves goes "out" of (0,0), you put a needle with one extremity
% on the starting point and the other one facing right and you turn it coun-
% terclockwise until it is tangent to the curve. The angle by which you have
% to turn the needle gives you the "out" angle.
% •
% When the curves goes "in" at (2,1.5), you put a needle with one extremity
% on the arrival point and the other one facing right and you turn it coun-
% terclockwise until it is tangent to the curve. The angle by which you have
% to turn the needle gives you the "in" angle.
% https://cremeronline.com/LaTeX/minimaltikz.pdf
% A very minimal introduction to TikZ, by Jacques Cremer
\end{tikzpicture}

```

## 7.5 $V_{out}(I_{out})$



```

\begin{tikzpicture}
  \begin{axis}[ %title={4Hz Sine Wave},
    % width=7cm,
    % height=5cm,
    axis lines=middle,
    % ymin=-10,
    ymax=1.5,
    xlabel={I_{out}},
    xticklabels={},
    yticklabels={},
    % ytick={-10,-8,-6,-5,-4,-3,-2,-1,1,2,3,4,5,6,8,10}
    ylabel={V_{out}},
    % grid=both,
    % grid style={line width=.1pt, draw=black!60},
    % major grid style={line width=.2pt,draw=black},
  ]

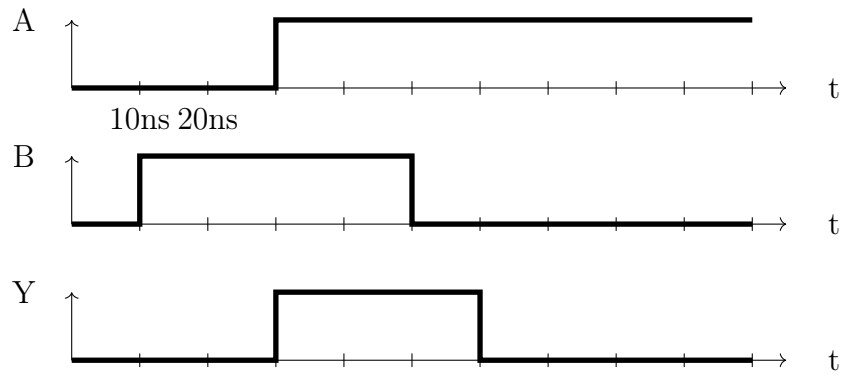
```

```

% ultra thick,
% minor tick num=5,
% enlargelimits={abs=0.5},
% axis line style={latex-latex},
yticklabel style={font=\normalsize,fill=white},
xlabel style={at={{(ticklabel* cs:1)}},anchor=north west},
% ylabel style={at={{(ticklabel* cs:1)}},anchor=south west},
]
\addplot[
domain=0:2,
thick,
samples=100
]
{1};
% \addlegendentry{$V_{in}$}
\addplot[
domain=2:3,
thick,
samples=100
]
{-x+3};
\end{axis}
\draw[dashed] (4.55,0) -- (4.55,5);
\draw[decorate, decoration={brace, amplitude=5pt}] ([yshift=-0.2cm]4.55,0)--
↪ node[below=0.25cm, text width=4cm]
{Grosse charge,  $I_{out}$  est donc faible et la Zener est en avalanche. La
↪ charge est régulée.}([yshift=-0.2cm]0,0); % Pour avoir une accolade avec la
↪ pointe vers le bas, d'abord donner la coordonnee de droite.
\draw[decorate, decoration={brace, amplitude=5pt}] ([yshift=-0.2cm]6.85,0)--
↪ node[below=0.25cm, text width=2cm]
{Diviseur résistif, la Zener est bloquante.}([yshift=-0.2cm]4.55,0); % Pour
↪ avoir une accolade avec la pointe vers le bas, d'abord donner la coordonnee
↪ de droite.
\draw [->] (0,4.5) to [out=10,in=170] node[above]{ $R_{ch}$  \searrow} (6.85,4.5);
% Note that I had to replace the - by "to". Notice how the angles work:
% •
% When the curves goes "out" of (0,0), you put a needle with one extremity
% on the starting point and the other one facing right and you turn it coun-
% terclockwise until it is tangent to the curve. The angle by which you have
% to turn the needle gives you the "out" angle.
% •
% When the curves goes "in" at (2,1.5), you put a needle with one extremity
% on the arrival point and the other one facing right and you turn it coun-
% terclockwise until it is tangent to the curve. The angle by which you have
% to turn the needle gives you the "in" angle.
% https://cremeronline.com/LaTeX/minimaltikz.pdf
% A very minimal introduction to TikZ, by Jacques Cremer
\end{tikzpicture}

```

## 7.6 Time graph 1



```

\usetikzlibrary{calc}
{
  \draw [->] (0,0) -- (0,1);
  \node [anchor=east] at (0,1) {A};
  \draw [->] (0,0) -- (10.5,0);
  \node [anchor=west] at (10.5,0) {t};

  \foreach \x in {1,2,...,10} \draw (\x,-0.1) -- (\x,0.1);
  \foreach \x in {1,2,...,10} \draw (\x,-0.1-2) -- (\x,0.1-2);
  \foreach \x in {1,2,...,10} \draw (\x,-0.1-4) -- (\x,0.1-4);
  \node [anchor=north, inner sep=0pt, outer sep=0pt] at (1,0.25) {10ns};
  \node [anchor=north, inner sep=0pt, outer sep=0pt] at (2,0.25) {20ns};

  \draw [->] (0,-2) -- (0,1-2);
  \node [anchor=east] at (0,1-2) {B};
  \draw [->] (0,-2) -- (10.5,-2);
  \node [anchor=west] at (10.5,-2) {t};

  \draw [->] (0,-4) -- (0,1-4);
  \node [anchor=east] at (0,1-4) {Y};
  \draw [->] (0,-4) -- (10.5,-4);
  \node [anchor=west] at (10.5,-4) {t};

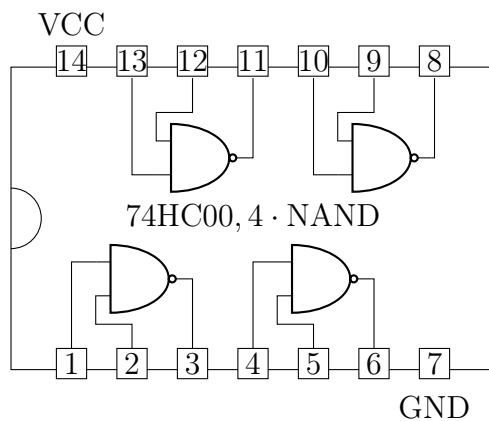
  \draw [line width=2pt] (0,0) -| (3,1) -| (10,1); %A
  \draw [line width=2pt] (0,0-2) -| (1,1-2) -| (5,0-2) -- (10,0-2); %B

  \draw [line width=2pt] (0,-4) -| (3,1-4) -| (6,0-4) -- (10,0-4); %Y
}
\end{tikzpicture}

```

## 8 Miscellaneous

### 8.1 74HC00



```
\begin{circuitikz}[scale=0.8] \draw
(4,2.5) node [anchor=center] {$74HC00, 4\cdot NAND$}
(2.8,1.5) node [american nand port,scale=0.8] (nand1) {}
(1,0) node (in11) {}
(2,0) node (in12) {}
(3,0) node (out1) {}
(in11) |- (nand1.in 1)
(in12) |- ++(-0.6,0.75)|- (nand1.in 2)
(out1) |- (nand1.out)

(2.8+3,1.5) node [american nand port,scale=0.8] (nand2) {}
(1+3,0) node (in21) {}
(2+3,0) node (in22) {}
(3+3,0) node (out2) {}
(in21) |- (nand2.in 1)
(in22) |- ++(-0.6,0.75)|- (nand2.in 2)
(out2) |- (nand2.out)

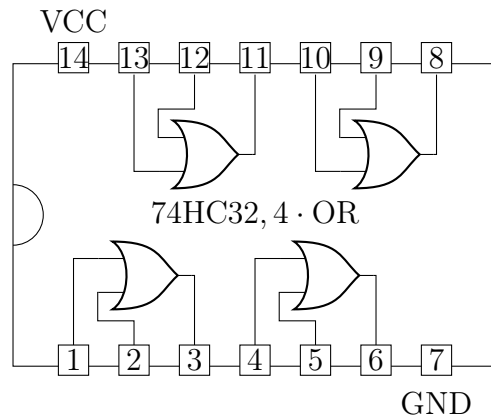
(1+2.8,5-1.5) node [american nand port,scale=0.8] (nand3) {}
(1+1,5) node (in31) {}
(2+1,5) node (in32) {}
(3+1,5) node (out3) {}
(in31) |- (nand3.in 2)
(in32) |- ++(-0.6,-0.75)|- (nand3.in 1)
(out3) |- (nand3.out)

(1+2.8+3,5-1.5) node [american nand port,scale=0.8] (nand4) {}
(2+3,5) node (in41) {}
(3+3,5) node (in42) {}
(4+3,5) node (out4) {}
(in41) |- (nand4.in 2)
(in42) |- ++(-0.6,-0.75)|- (nand4.in 1)
(out4) |- (nand4.out)

(7,0-0.25) node [anchor=north] (gnd) {GND}
(1,5+0.35) node [anchor=south] (vcc) {VCC}

;\draw (0,0)rectangle (8,5);
\foreach \x in {1,2,...,7} \filldraw [fill=white] (\x-0.25,-0.15) rectangle (\x+0.25,0.35) (\x,0.1) node
\larrow {\x};
\foreach \x in {1,2,...,7} \filldraw [fill=white] (\x-0.25,5-0.15) rectangle (\x+0.25,5+0.35);
\foreach \x in {8,9,...,14} \draw (15-\x,5+0.1) node {\x};
\draw (0,2) arc[start angle=-90, end angle=90, radius=0.5];
\end{circuitikz}
```

## 8.2 74HC32



```
\begin{circuitikz}[scale=0.8] \draw
  (4,2.5) node [anchor=center] {$74HC32, 4\cdot OR$}
  (2.8,1.5) node [american or port,scale=0.8] (or1) {}
  (1,0) node (in11) {}
  (2,0) node (in12) {}
  (3,0) node (out1) {}
  (in11) |- (or1.in 1)
  (in12) |- ++(-0.6,0.75)|- (or1.in 2)
  (out1) |- (or1.out)

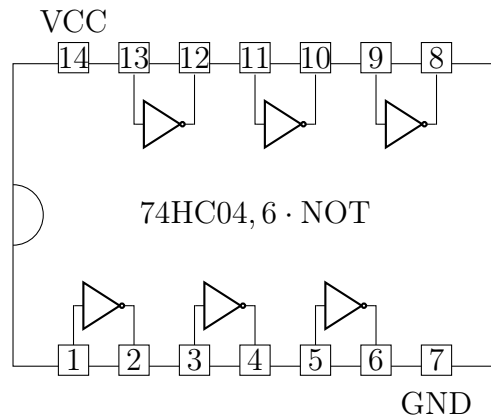
  (2.8+3,1.5) node [american or port,scale=0.8] (or2) {}
  (1+3,0) node (in21) {}
  (2+3,0) node (in22) {}
  (3+3,0) node (out2) {}
  (in21) |- (or2.in 1)
  (in22) |- ++(-0.6,0.75)|- (or2.in 2)
  (out2) |- (or2.out)

  (1+2.8,5-1.5) node [american or port,scale=0.8] (or3) {}
  (1+1,5) node (in31) {}
  (2+1,5) node (in32) {}
  (3+1,5) node (out3) {}
  (in31) |- (or3.in 2)
  (in32) |- ++(-0.6,-0.75)|- (or3.in 1)
  (out3) |- (or3.out)

  (1+2.8+3,5-1.5) node [american or port,scale=0.8] (or4) {}
  (2+3,5) node (in41) {}
  (3+3,5) node (in42) {}
  (4+3,5) node (out4) {}
  (in41) |- (or4.in 2)
  (in42) |- ++(-0.6,-0.75)|- (or4.in 1)
  (out4) |- (or4.out)

  (7,0-0.25) node [anchor=north] (gnd) {GND}
  (1,5+0.35) node [anchor=south] (vcc) {VCC}
;
\draw (0,0)rectangle (8,5);
\foreach \x in {1,2,...,7} \filldraw [fill=white] (\x-0.25,-0.15) rectangle (\x+0.25,0.35) (\x,0.1) node
  \x;
\foreach \x in {1,2,...,7} \filldraw [fill=white] (\x-0.25,5-0.15) rectangle (\x+0.25,5+0.35);
\foreach \x in {8,9,...,14} \draw (15-\x,5+0.1) node {\x};
\draw (0,2) arc[start angle=-90, end angle=90, radius=0.5];
\end{circuitikz}
```

## 8.3 74HC04



```
\begin{circuitikz}[scale=0.8] \draw
  (4,2.5) node [anchor=center] {$74HC04, 6\cdot NOT$}
  (1.5,1) node [american not port,scale=0.55] (not1) {}
  (1,0) node (in11) {}
  (2,0) node (out1) {}
  (in11) |- (not1.in)
  (out1) |- (not1.out)

  (1.5+2,1) node [american not port,scale=0.55] (not2) {}
  (1+2,0) node (in21) {}
  (2+2,0) node (out2) {}
  (in21) |- (not2.in)
  (out2) |- (not2.out)

  (1.5+4,1) node [american not port,scale=0.55] (not5) {}
  (1+4,0) node (in51) {}
  (2+4,0) node (out5) {}
  (in51) |- (not5.in)
  (out5) |- (not5.out)

  (1+1.5,5-1) node [american not port,scale=0.55] (not3) {}
  (1+1,5) node (in31) {}
  (2+1,5) node (out3) {}
  (in31) |- (not3.in)
  (out3) |- (not3.out)

  (1+1.5+2,5-1) node [american not port,scale=0.55] (not4) {}
  (2+2,5) node (in41) {}
  (3+2,5) node (out4) {}
  (in41) |- (not4.in)
  (out4) |- (not4.out)

  (1+1.5+4,5-1) node [american not port,scale=0.55] (not6) {}
  (2+4,5) node (in61) {}
  (3+4,5) node (out6) {}
  (in61) |- (not6.in)
  (out6) |- (not6.out)

  (7,0-0.25) node [anchor=north] (gnd) {GND}
  (1,5+0.35) node [anchor=south] (vcc) {VCC}
;\draw (0,0)rectangle (8,5);
\foreach \x in {1,2,...,7} \filldraw [fill=white] (\x-0.25,-0.15) rectangle (\x+0.25,0.35) (\x,0.1) node
\larrow {\x};
\foreach \x in {1,2,...,7} \filldraw [fill=white] (\x-0.25,5-0.15) rectangle (\x+0.25,5+0.35);
\foreach \x in {8,9,...,14} \draw (15-\x,5+0.1) node {\x};
\draw (0,2) arc[start angle=-90, end angle=90, radius=0.5];
\end{circuitikz}
```

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