

# PSTricks

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## **pst-circ**

A PSTricks package for drawing electric circuits; v.1.49

December 22, 2008

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The package `pst-circ` is a collection of graphical elements based on `PStricks` that can be used to facilitate display of electronic circuit elements. For example, an equivalent circuit of a voltage source, its source impedance, and a connected load can easily be constructed along with arrows indicating current flow and potential differences. The emphasis is upon the circuit elements and the details of the exact placement are hidden as much as possible so the author can focus on the circuitry without the distraction of sorting out the underlying vector graphics.

`pst-circ` loads by default the following packages: `pst-node`, `multido`, `pst-xkey`, and, of course `pstricks`. All should be already part of your local  $\text{\TeX}$  installation. If not, or in case of having older versions, go to <http://www.CTAN.org/> and load the newest version.

Thanks to:

Rafal Bartczuk, François Boone, Jean-Côme Charpentier, Patrick Drechsler, Manuel Luque, Ted Pavlic, Alan Ristow, Douglas Waud, and Richard Weissnar.

# 1 The basic system

## 1.1 Parameters

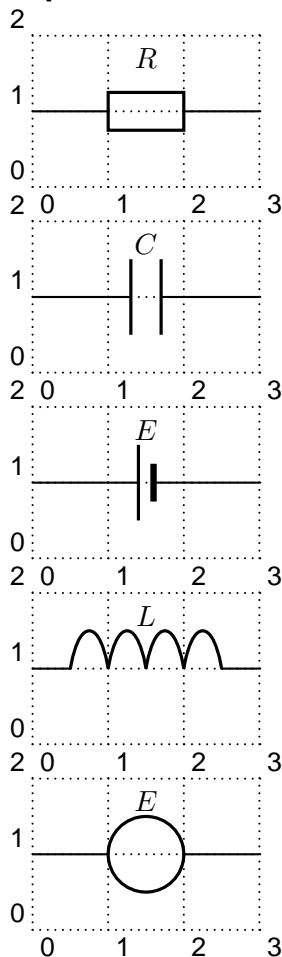
There are specific parameters defined to change easily the behaviour of the pst-circ objects you are drawing.

<i>name</i>	<i>type</i>	<i>default</i>
intensity	boolean	<i>false</i>
intensitylabel	string	
intensitylabeloffset	dimension	<i>0.5</i>
intensitycolor	color	<i>black</i>
intensitylabelcolor	color	<i>black</i>
intensitywidth	dimension	<i>\pslinewidth</i>
tension	boolean	<i>false</i>
tensionlabel	string	
tensionoffset	dimension	<i>1</i>
tensionlabeloffset	dimension	<i>1.2</i>
tensioncolor	color	<i>black</i>
tensionlabelcolor	color	<i>black</i>
tensionwidth	dimension	<i>\pslinewidth</i>
labeloffset	dimension	<i>0.7</i>
labelangle	label angle	<i>0</i>
labelInside	integer	<i>0</i>
dipoleconvention		<i>receptor</i>
directconvetion	boolean	<i>true</i>
dipolestyle	string	<i>normal</i>
variable	boolean	<i>false</i>
parallel	boolean	<i>false</i>
parallelarm	dimension	<i>1.5</i>
parallelep	real	<i>0</i>
parallelnode	boolean	<i>false</i>
intersect	boolean	<i>false</i>
intersectA	node	
intersectB	node	
OAinvert	boolean	<i>true</i>
OApertect	boolean	<i>true</i>
OAIplus	boolean	<i>false</i>
OAIMinus	boolean	<i>false</i>
OAIout	boolean	<i>false</i>
OAIpluslabel	string	
OAIMinuslabel	string	
OAIoutlabel	string	
transistorcircle	boolean	<i>true</i>
transistorinvert	boolean	<i>false</i>
transistoribase	boolean	<i>false</i>
transistoricollector	boolean	<i>false</i>
transistoriemitter	boolean	<i>false</i>

<i>name</i>	<i>type</i>	<i>default</i>
transistoribaselabel	string	
transistoricollectorlabel	string	
transistoriemitterlabel	string	
TRot	angle	0
edge	macro	\ncangles
transistortype	string	NPN
FETchanneltype	string	N
FETmemory	boolean	false
primarylabel	string	
secondarylabel	string	
transformeriprimary	boolean	false
transformerissecondary	boolean	false
transformeriprimarylabel	string	
transformerissecondarylabel	string	
tripolestyle	string	normal

## 1.2 Macros

### Dipole macros



```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \resistor(A)(B){$R$}
5 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \capacitor(A)(B){$C$}
5 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \battery(A)(B){$E$}
5 \end{pspicture}

```

```

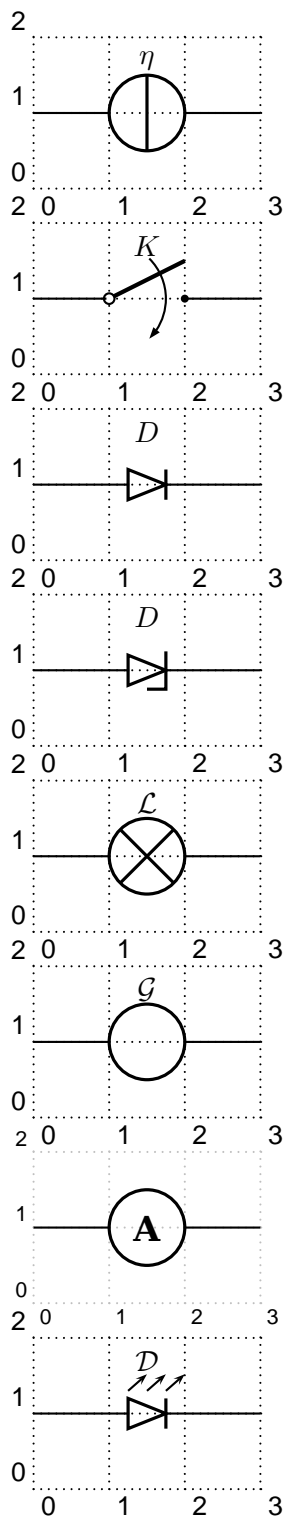
1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \coil(A)(B){$L$}
5 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \Ucc(A)(B){$E$}
5 \end{pspicture}

```



```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \Icc(A)(B){\eta}
5 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \switch(A)(B){K}
5 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \diode(A)(B){D}
5 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \Zener(A)(B){D}
5 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \lamp(A)(B){\mathcal L}
5 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \circledipole(A)(B){\mathcal G}
5 \end{pspicture}

```

```

1 \begin{pspicture}[showgrid=true](3,2)
2   \node(0,1){A}
3   \node(3,1){B}
4   \circledipole[labeloffset=0](A)(B){\Large\textbf{A}}
5 \end{pspicture}

```

```

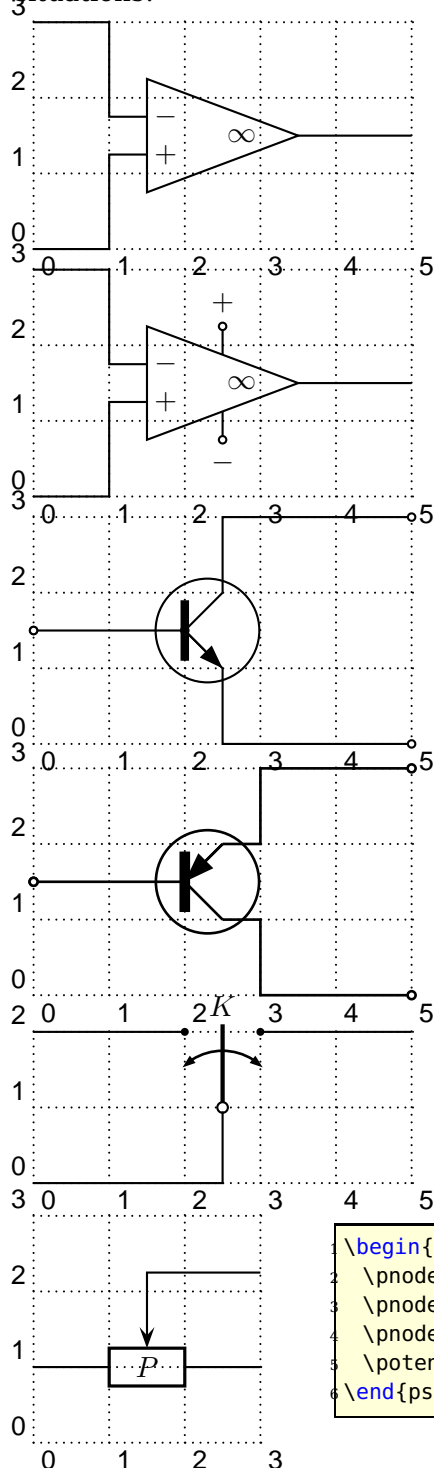
1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \LED(A)(B){\mathcal D}
5 \end{pspicture}

```

### Tripole macros

Obviously, tripoles are not node connections. So `pst-circ` tries its best to adjust the position of the tripole regarding the three nodes. Internally, the connections are

done by the `\ncangle` pst-node macro. However, the auto-positionning and the auto-connections are not always well chosen<sup>1</sup>, so don't try to use tripole macros in strange situations!



```

1 \begin{pspicture}(5,3)\psgrid
2   \nnode(0,0){A}
3   \nnode(0,3){B}
4   \nnode(5,1.5){C}
5   \OA(B)(A)(C)
6 \end{pspicture}

```

```

1 \begin{pspicture}(5,3)\psgrid
2   \nnode(0,0){A}
3   \nnode(0,3){B}
4   \nnode(5,1.5){C}
5   \OA[OApower=true](B)(A)(C)
6 \end{pspicture}

```

```

1 \begin{pspicture}(5,3)\psgrid
2   \nnode(0,1.5){A}
3   \nnode(5,0){B}
4   \nnode(5,3){C}
5   \transistor[basesep=2cm,arrows=o-o](A)(B)(C)
6 \end{pspicture}

```

```

1 \begin{pspicture}(5,3)\psgrid
2   \nnode(0,1.5){A}\psset{linewidth=1pt}
3   \transistor[transistortype=PNP,basesep=2cm,
4     arrows=o-o](A){Emitter}{Collector}
5   \psline{o-}(5,3)(3,3)(3,3|Collector)(Collector)
6   \psline{o-}(5,0)(3,0)(3,3|Emitter)(Emitter)
7   \psline{o-}(A)([nodesep=2]A)
8 \end{pspicture}

```

```

1 \begin{pspicture}(5,2)\psgrid
2   \nnode(0,2){A}
3   \nnode(5,2){B}
4   \nnode(0,0){C}
5   \Tswitch(A)(B)(C){$K$}
6 \end{pspicture}

```

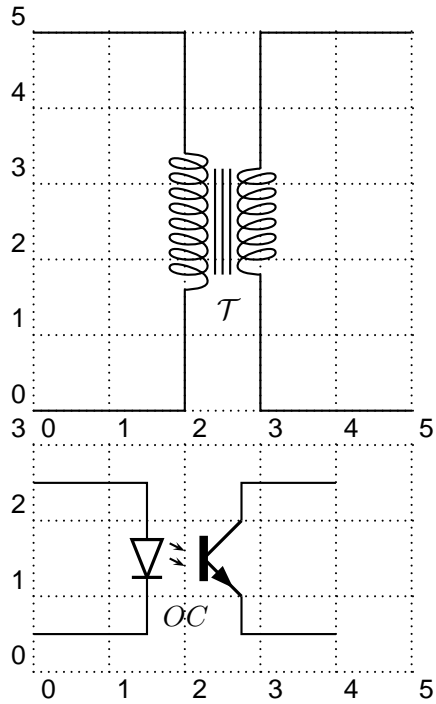
```

1 \begin{pspicture}(3,3)\psgrid
2   \nnode(0,1){A}
3   \nnode(3,1){B}
4   \nnode(3,2.25){C}
5   \potentiometer[labeloffset=0pt](A)(B)(C){$P$}
6 \end{pspicture}

```

<sup>1</sup> This is something we are working on. I think that auto-positionning and auto-connections should be done at PostScript level and not at PSTricks level. If someone has any ideas, please mail us.

### Quadrupole macros



```

1 \begin{pspicture}(5,5)\psgrid
2   \pnode(0,5){A}
3   \pnode(0,0){B}
4   \pnode(5,5){C}
5   \pnode(5,0){D}
6   \transformer(A)(B)(C)(D){\mathcal T}
7 \end{pspicture}

```

```

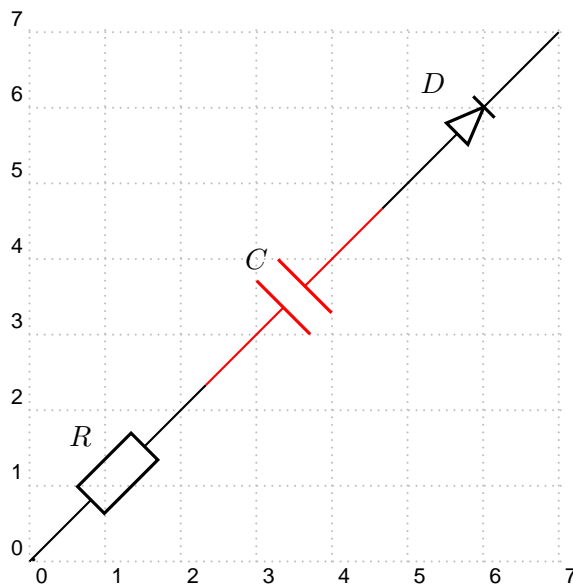
1 \begin{pspicture}(5,3)\psgrid
2   \pnode(0,2.5){A}
3   \pnode(0,0.5){B}
4   \pnode(4,2.5){C}
5   \pnode(4,0.5){D}
6   \optoCoupler(A)(B)(C)(D){$OC$}
7 \end{pspicture}

```



## Multidipole

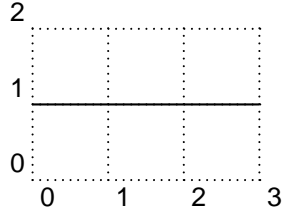
`\multidipole` is a macro that allows multiple dipoles to be drawn between two specified nodes. `\multidipole` takes as many arguments as you want. **Note the dot that is after the last dipole.**



```
\begin{pspicture}[showgrid=true](7,7)
  \pnode(0,0){A}
  \pnode(7,7){B}
  \multidipole(A)(B)\resistor{$R$}%
    \capacitor[linecolor=red]{$C$}%
    \diode{$D$}{.}
\end{pspicture}
```

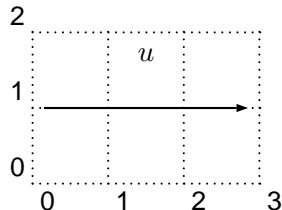
Important: for the time being, `\multidipole` takes optional arguments but does not restore original values. We recommend not using it.

## Wire

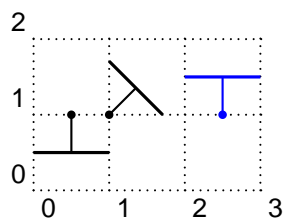


```
\begin{pspicture}(3,2)\psgrid
  \pnode(0,1){A}
  \pnode(3,1){B}
  \wire(A)(B)
\end{pspicture}
```

## Potential



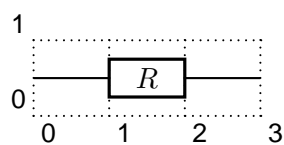
```
\begin{pspicture}(3,2)\psgrid
  \pnode(0,1){A}
  \pnode(3,1){B}
  \tension(A)(B){$u$}
\end{pspicture}
```

**ground**

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0.5,1){A}
3   \node(1,1){B}
4   \node(2.5,1){C}
5   \ground(A)
6   \ground{135}(B)
7   \ground[linecolor=blue]{180}(C)
8 \end{pspicture}

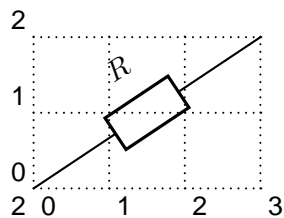
```

**1.3 Parameters****Label parameters**

```

1 \begin{pspicture}(3,1)\psgrid
2   \node(0,.5){A}
3   \node(3,.5){B}
4   \resistor[labeloffset=0](A)(B){$R$}
5 \end{pspicture}

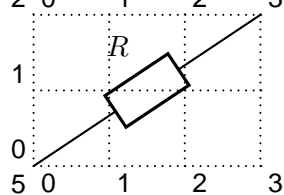
```



```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,0){A}
3   \node(3,2){B}
4   \resistor[labelangle=:U](A)(B){$R$}
5 \end{pspicture}

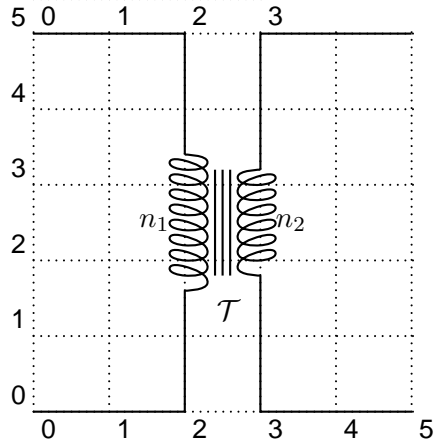
```



```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,0){A}
3   \node(3,2){B}
4   \resistor[labelangle=0](A)(B){$R$}
5 \end{pspicture}

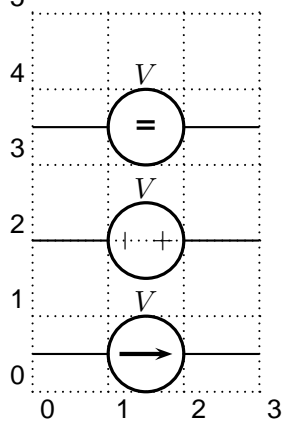
```



```

1 \begin{pspicture}(5,5)\psgrid
2   \node(0,5){A}
3   \node(0,0){B}
4   \node(5,5){C}
5   \node(5,0){D}
6   \transformer[primarylabel=$n_1$,
7     secondarylabel=$n_2$](A)(B)(C)(D){$\mathcal{T}$}
8 \end{pspicture}

```



```

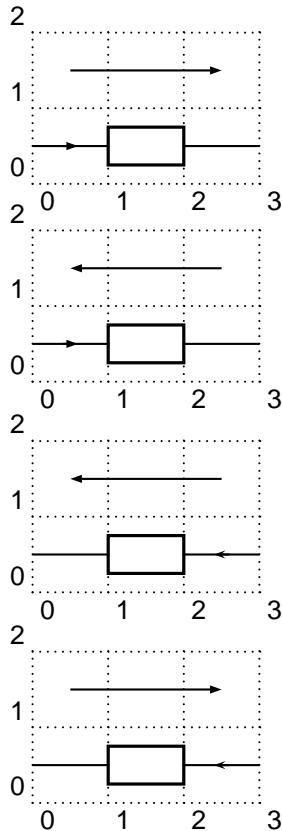
1 \begin{pspicture}(3,4.5)\psgrid
2   \node(0,.5){A}
3   \node(3,.5){B}
4   \Ucc[labelInside=1](A)(B){$V$}
5   \node(0,2){A}
6   \node(3,2){B}
7   \Ucc[labelInside=2](A)(B){$V$}
8   \node(0,3.5){A}
9   \node(3,3.5){B}
10  \Ucc[labelInside=3](A)(B){$V$}
11 \end{pspicture}

```

### Current intensity and electrical potential parameters

If the intensity parameter is set to true, an arrow is drawn on the wire connecting one of the nodes to the dipole. If the tension parameter is set to true, an arrow is drawn parallel to the dipole.

The way those arrows are drawn is set by dipoleconvention and directconvention parameters. dipoleconvention can take two values : generator or receptor. directconvention is a boolean.



```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,.5){A}
3   \node(3,.5){B}
4   \resistor[intensity,tension](A)(B){}
5 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,.5){A}
3   \node(3,.5){B}
4   \resistor[intensity,tension,
5     dipoleconvention=generator](A)(B){}
6 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,.5){A}
3   \node(3,.5){B}
4   \resistor[intensity,tension,
5     directconvention=false](A)(B){}
6 \end{pspicture}

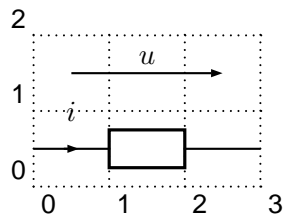
```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,.5){A}
3   \node(3,.5){B}
4   \resistor[intensity,tension,
5     dipoleconvention=generator,directconvention=false](A)(B){}
6 \end{pspicture}

```

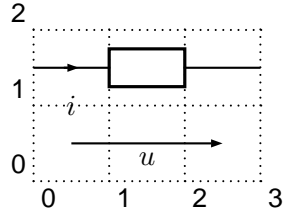
If intensitylabel is set to a non empty argument, then intensity is automatically set to true. If tensionlabel is set to a non empty argument, then tension is automatically set to true.



```

\begin{pspicture}(3,2)\psgrid
\pnode(0,.5){A}
\pnode(3,.5){B}
\resistor[intensitylabel=$i$,tensionlabel=$u$](A)(B){}
\end{pspicture}

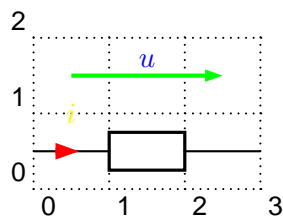
```



```

\begin{pspicture}(3,2)\psgrid
\pnode(0,1.5){A}
\pnode(3,1.5){B}
\resistor[intensitylabel=$i$,intensitylabeloffset=-0.5,
tensionlabel=$u$,tensionlabeloffset=-1.2,
tensionoffset=-1](A)(B){}
\end{pspicture}

```

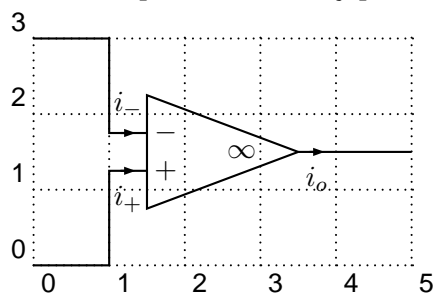


```

\begin{pspicture}(3,2)\psgrid
\pnode(0,.5){A}
\pnode(3,.5){B}
\resistor[intensitylabel=$i$,intensitywidth=3\pslinewidth,
intensitycolor=red,intensitylabelcolor=yellow,
tensionlabel=$u$,tensionwidth=2\pslinewidth,
tensioncolor=green,tensionlabelcolor=blue](A)(B){}
\end{pspicture}

```

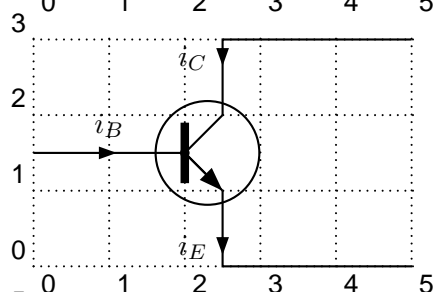
Some specific intensity parameters are available for tripoles and quadrupoles.



```

\begin{pspicture}(5,3)\psgrid
\pnode(0,0){A}
\pnode(0,3){B}
\pnode(5,1.5){C}
\OA[OAipluslabel=$i_+$,
OAiminuslabel=$i_- $,
OAioutlabel=$i_o$](B)(A)(C)
\end{pspicture}

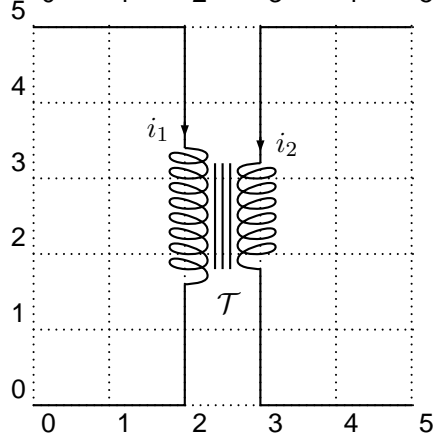
```



```

\begin{pspicture}(5,3)\psgrid
\pnode(0,1.5){A}
\pnode(5,0){B}
\pnode(5,3){C}
\transistor[basesep=2cm,transistoribaselabel=$i_-$
B$,
transistoricollectorlabel=$i_C$,
transistoriemitterlabel=$i_E$](A)(B)(C)
\end{pspicture}

```



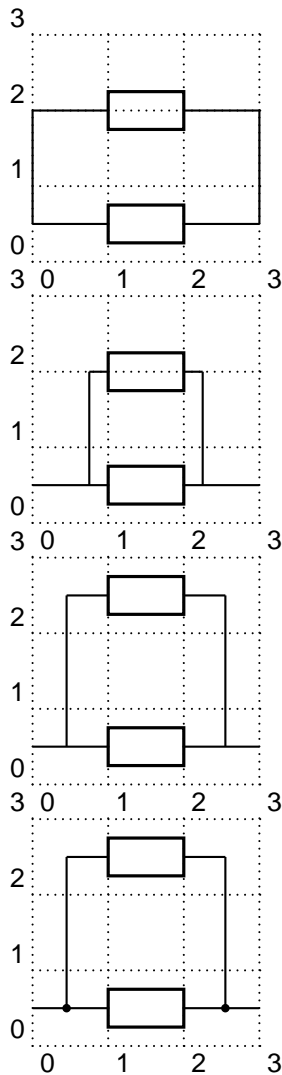
```

\begin{pspicture}(5,5)\psgrid
\pnode(0,5){A}
\pnode(0,0){B}
\pnode(5,5){C}
\pnode(5,0){D}
\transformer[transformerprimarylabel=$i_1$,
transformerissecondarylabel=$i_2$]%(
A)(B)(C)(D){$\mathcal{T}$}
\end{pspicture}

```

### Parallel parameters

If the `parallel` parameter is set to `true`, the dipole is drawn parallel to the line connecting the nodes.



```

1 \begin{pspicture}(3,3)\psgrid
2   \pnode(0,.5){A}
3   \pnode(3,.5){B}
4   \resistor(A)(B){}
5   \resistor[parallel](A)(B){}
6 \end{pspicture}

```

```

1 \begin{pspicture}(3,3)\psgrid
2   \pnode(0,.5){A}
3   \pnode(3,.5){B}
4   \resistor(A)(B){}
5   \resistor[parallel,parallelsep=.5](A)(B){}
6 \end{pspicture}

```

```

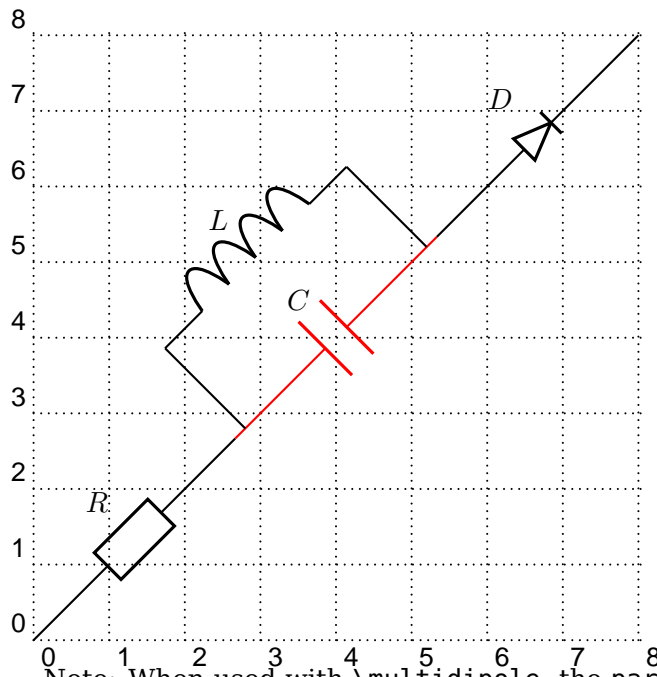
1 \begin{pspicture}(3,3)\psgrid
2   \pnode(0,.5){A}
3   \pnode(3,.5){B}
4   \resistor(A)(B){}
5   \resistor[parallel,parallelsep=.3,
6     parallelarm=2](A)(B){}
7 \end{pspicture}

```

```

1 \begin{pspicture}(3,3)\psgrid
2   \pnode(0,.5){A}
3   \pnode(3,.5){B}
4   \resistor(A)(B){}
5   \resistor[parallel,parallelsep=.3,
6     parallelarm=2,parallelnode](A)(B){}
7 \end{pspicture}

```



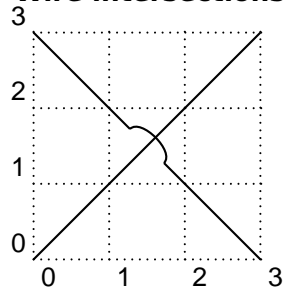
```

1 \begin{pspicture}(8,8)\psgrid
2   \nnode(0,0){A}
3   \nnode(8,8){B}
4   \multidipole(A)(B)\resistor{$R$}%
5   \capacitor[linecolor=red]{$C$}%
6   \coil[parallel,parallesep
7     =.1]{$L$}%
8   \diode{$D$}.
9 \end{pspicture}

```

Note: When used with `\multidipole`, the `parallel` parameter must not be set for the first dipole.

### Wire intersections

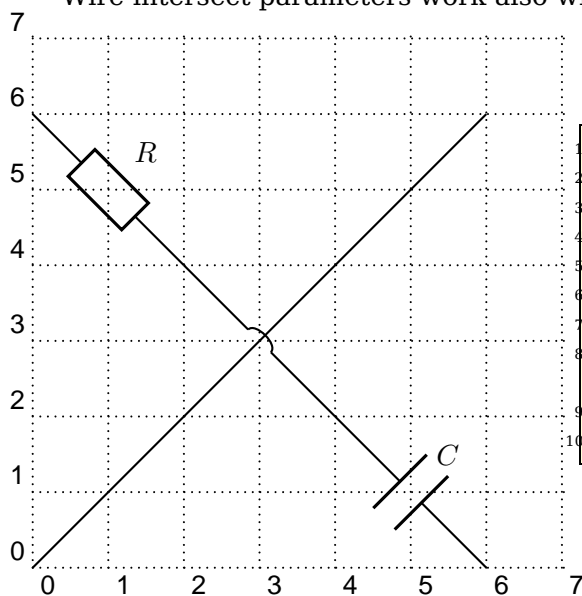


```

1 \begin{pspicture}(3,3)\psgrid
2   \nnode(0,0){A}
3   \nnode(3,3){B}
4   \nnode(0,3){C}
5   \nnode(3,0){D}
6   \wire(A)(B)
7   \wire[intersect,intersectA=A,intersectB=B](C)(D)
8 \end{pspicture}

```

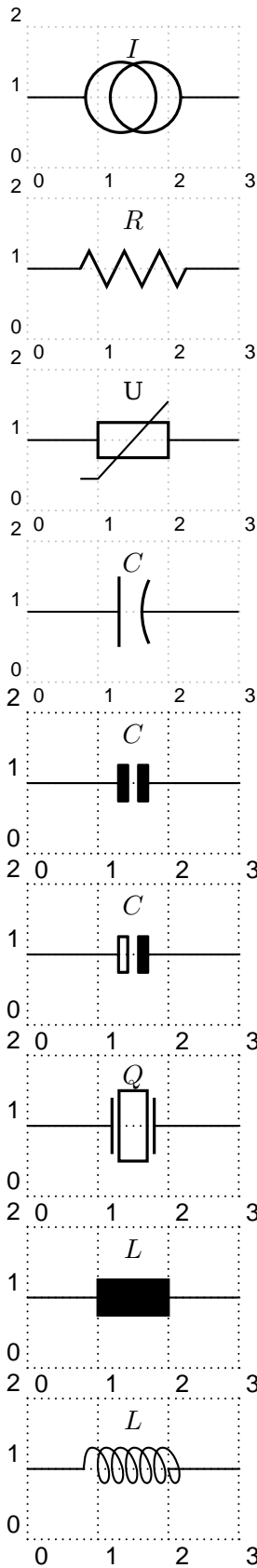
Wire intersect parameters work also with `\multidipole`.



```

1 \begin{pspicture}(7,7)\psgrid
2   \nnode(0,0){A}
3   \nnode(6,6){B}
4   \nnode(0,6){C}
5   \nnode(6,0){D}
6   \wire(A)(B)
7   \multidipole(C)(D)\resistor{$R$}%
8   \wire[intersect,intersectA=A,intersectB=B]
9     ]%
10  \capacitor{$C$}.
11 \end{pspicture}

```

**Dipole style parameters**

```

1 \begin{pspicture}[showgrid=true](3,2)
2   \node(0,1){A}
3   \node(3,1){B}
4   \Icc[dipolestyle=twoCircles](A)(B){I$}
5 \end{pspicture}

```

```

1 \begin{pspicture}[showgrid=true](3,2)
2   \node(0,1){A}
3   \node(3,1){B}
4   \resistor[dipolestyle=zigzag](A)(B){R$}
5 \end{pspicture}

```

```

1 \begin{pspicture}[showgrid=true](3,2)
2   \node(0,1){A}
3   \node(3,1){B}
4   \resistor[dipolestyle=varistor](A)(B){U}
5 \end{pspicture}

```

```

1 \begin{pspicture}[showgrid=true](3,2)
2   \node(0,1){A}
3   \node(3,1){B}
4   \capacitor[dipolestyle=chemical](A)(B){C$}
5 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \capacitor[dipolestyle=elektor](A)(B){C$}
5 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \capacitor[dipolestyle=elektorchemical](A)(B){C$}
5 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \capacitor[dipolestyle=crystal](A)(B){Q$}
5 \end{pspicture}

```

```

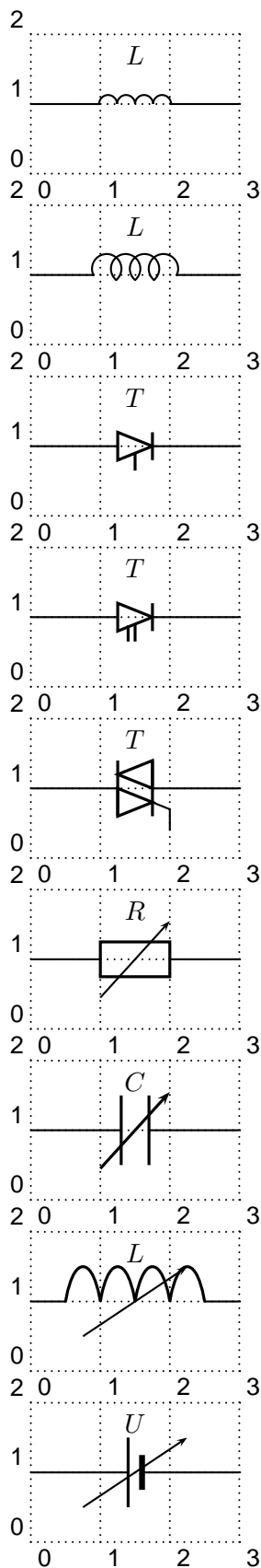
1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \coil[dipolestyle=rectangle](A)(B){L$}
5 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \coil[dipolestyle=curved](A)(B){L$}
5 \end{pspicture}

```



```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \coil[dipolestyle=elektor](A)(B){$L$}
5 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \coil[dipolestyle=elektorcurved](A)(B){$L$}
5 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \diode[dipolestyle=thyristor](A)(B){$T$}
5 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \diode[dipolestyle=GT0](A)(B){$T$}
5 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \diode[dipolestyle=triac](A)(B){$T$}
5 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \resistor[variable](A)(B){$R$}
5 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \capacitor[variable](A)(B){$C$}
5 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \coil[variable](A)(B){$L$}
5 \end{pspicture}

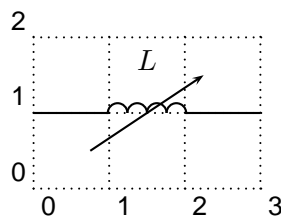
```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \battery[variable](A)(B){$U$}
5 \end{pspicture}

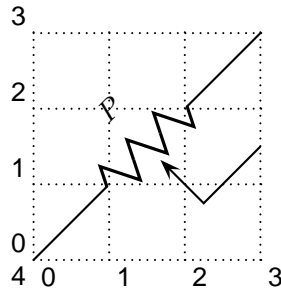
```



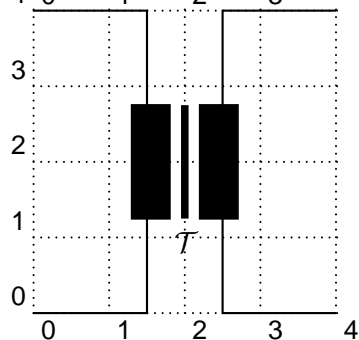


```
\begin{pspicture}(3,2)\psgrid
\pnode(0,1){A}
\pnode(3,1){B}
\coil[dipolestyle=elektor,variable](A)(B){$L$}
\end{pspicture}
```

In the following example the parameter `dipolestyle` is used for a tripole and quadrupole, because the coils are drawn as rectangles and the resistor as a zigzag.

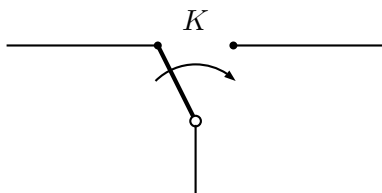


```
\begin{pspicture}(3,3)\psgrid
\pnode(0,0){A}
\pnode(3,3){B}
\pnode(3,1.5){C}
\potentiometer[dipolestyle=zigzag,%
labelangle=:U](A)(B)(C){$P$}
\end{pspicture}
```

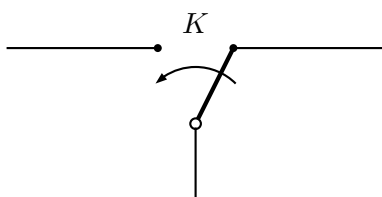


```
\begin{pspicture}(4,4)\psgrid
\pnode(0,4){A}
\pnode(0,0){B}
\pnode(4,4){C}
\pnode(4,0){D}
\transformer[dipolestyle=rectangle](A)(B)(C)(D){\mathcal T$}
\end{pspicture}
```

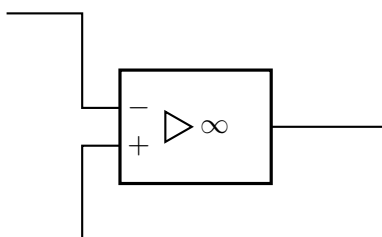
### Tripole style parameters



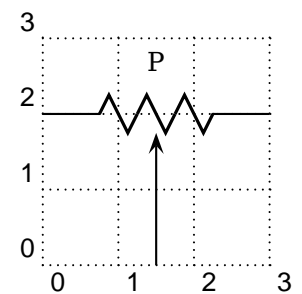
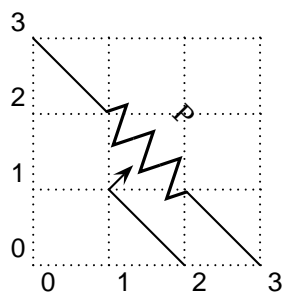
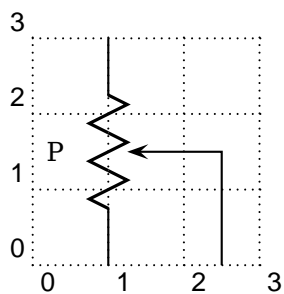
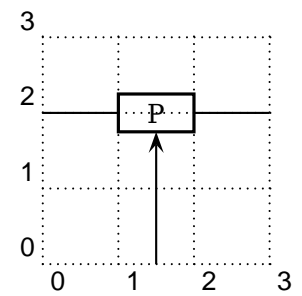
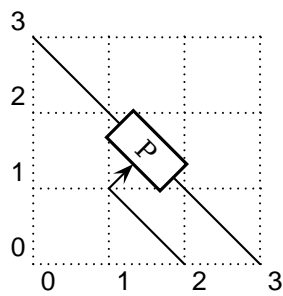
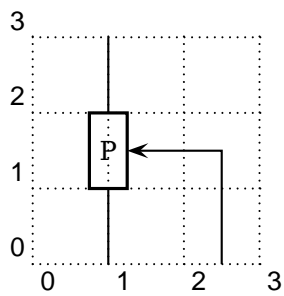
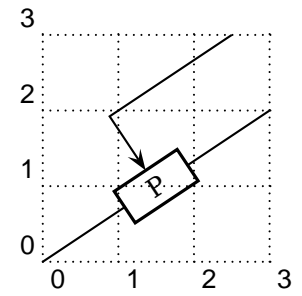
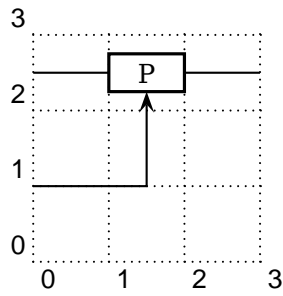
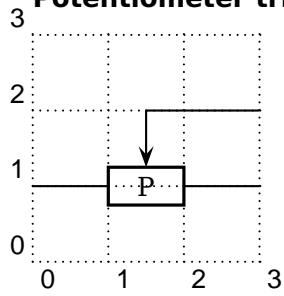
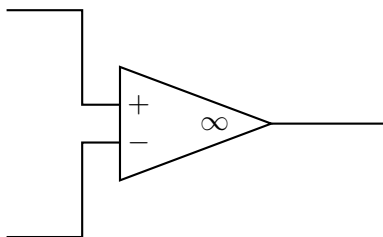
```
\begin{pspicture}(5,3)
\pnode(0,2){A}
\pnode(5,2){B}
\pnode(0,0){C}
\Tswitch[tripolestyle=left](A)(B)(C){$K$}
\end{pspicture}
```



```
\begin{pspicture}(5,3)
\pnode(0,2){A}
\pnode(5,2){B}
\pnode(0,0){C}
\Tswitch[tripolestyle=right](A)(B)(C){$K$}
\end{pspicture}
```



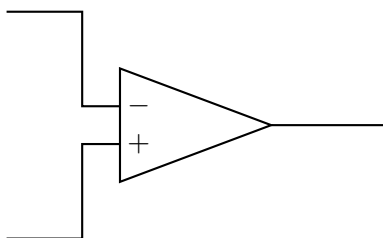
```
\begin{pspicture}(5,3)
\pnode(0,3){A}
\pnode(0,0){B}
\pnode(5,1.5){C}
\OA[tripolestyle=french](A)(B)(C)
\end{pspicture}
```

**Potentiometer tripole****Other Parameters**

```

1 \begin{pspicture}(5,3)
2   \pnode(0,0){A}
3   \pnode(0,3){B}
4   \pnode(5,1.5){C}
5   \OA[OAinvert=false](B)(A)(C)
6 \end{pspicture}

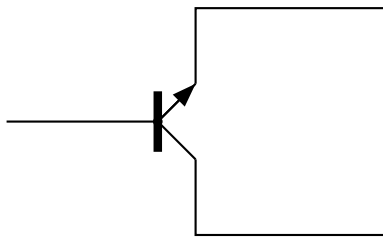
```



```

1 \begin{pspicture}(5,3)
2   \pnode(0,0){A}
3   \pnode(0,3){B}
4   \pnode(5,1.5){C}
5   \OA[OAperfect=false](B)(A)(C)
6 \end{pspicture}

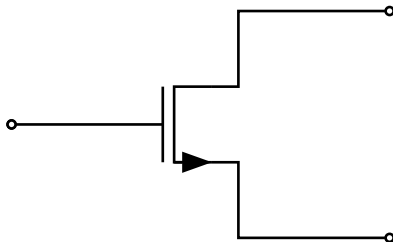
```



```

1 \begin{pspicture}(5,3)
2   \pnode(0,1.5){A}
3   \pnode(5,0){B}
4   \pnode(5,3){C}
5   \transistor[basesep=2cm,%
6     transistorinvert,transistorcircle=false](A)(B)(
7     C)
8 \end{pspicture}

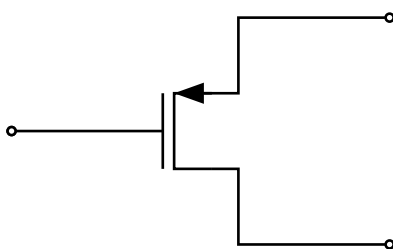
```



```

1 \begin{pspicture}(5,3)
2   \pnode(0,1.5){A}\psset{linewidth=1pt}
3   \transistor[basesep=2cm,arrows=o-o,
4     transistortype=FET](A){Emitter}{Collector}
5   \psline{o-}(5,3)(3,3)(3,3|Collector)(Collector)
6   \psline{o-}(5,0)(3,0)(3,3|Emitter)(Emitter)
7   \psline{o-}(A)([nodesep=2]A)
8 \end{pspicture}

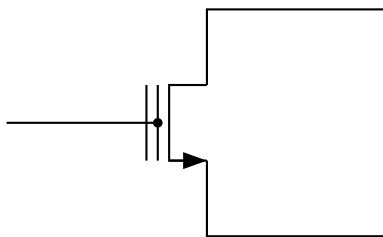
```



```

1 \begin{pspicture}(5,3)
2   \pnode(0,1.5){A}\psset{linewidth=1pt}
3   \transistor[basesep=2cm,arrows=o-o,
4     transistortype=FET,
5     FETchanneltype=P](A){Emitter}{Collector}
6   \psline{o-}(5,3)(3,3)(3,3|Collector)(Collector)
7   \psline{o-}(5,0)(3,0)(3,3|Emitter)(Emitter)
8   \psline{o-}(A)([nodesep=2]A)
9 \end{pspicture}

```



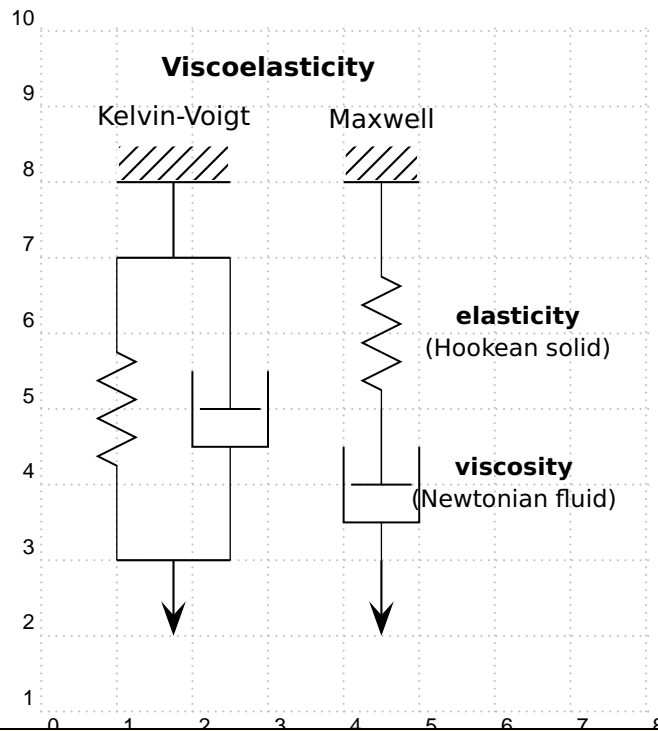
```

1 \begin{pspicture}(5,3)
2 \transistor[basesep=2cm,transistortype=FET,
3   FETmemory=true](0,1.5)(5,0)(5,3)
4 \end{pspicture}

```

## 1.4 Special objects

### \dashpot

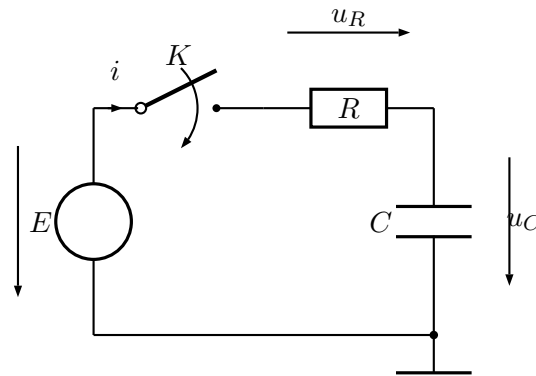


```

1 \newcommand*\pswall[3]{% ll ur lr
2   \psframe[linecolor=white,fillstyle=hlines,hatchcolor=black](#1)(#2)% (ll)(ur)
3   \psline[linecolor=black](#1)(#3)}
4 \begin{pspicture}(showgrid=true)(0.5,1)(8,10)
5   \rput(3,9.5){\sffamily \textbf{Viscoelasticity}}
6   % Kelvin-Voigt model (spring and dashpot parallel): =====
7   \rput[c](1.75,8.85){\sffamily Kelvin-Voigt}
8   \pswall{1,8}{2.5,8.5}{2.5,8}% top
9   \psline(1.75,8)(1.75,7)% top vertical line
10  % node definitions:
11  \pnode(1,7){ul1}\pnode(2.5,7){ur1} \pnode(1,3){ll1}\pnode(2.5,3){lr1}%
12  \psline(ur1)(ur1)% top line
13  \psline(ll1)(lr1)% bottom line
14  \resistor[dipolestyle=zigzag,linewidth=0.5pt](ul1)(ll1){}% spring
15  \dashpot[linewidth=0.5pt](ur1)(lr1){}% dashpot
16  \psline[arrowscale=3]{->}(1.75,3)(1.75,2)% force
17  % Maxwell model (spring and dashpot serial): =====
18  \rput[c](4.5,8.85){\sffamily Maxwell}
19  \pswall{4,8}{5,8.5}{5,8}% top
20  \pnode(4.5,8){t}\pnode(4.5,4){b}% node definitions
21  \resistor[dipolestyle=zigzag,linewidth=0.5pt,labeloffset=1.8](t)(b)% spring
22  {\sffamily\small\begin{tabular}{c}\textbf{elasticity}\\(Hookean solid)\end{tabular}
23  }% end spring
24  \dashpot[linewidth=0.5pt,labeloffset=1.8](4.5,5)(4.5,3)% dashpot
25  {\sffamily\small\begin{tabular}{c}\textbf{viscosity}\\(Newtonian fluid)\end{tabular}
26  }% end dashpot
27  \psline[arrowscale=3]{->}(4.5,3)(4.5,2)% force
28 \end{pspicture}

```

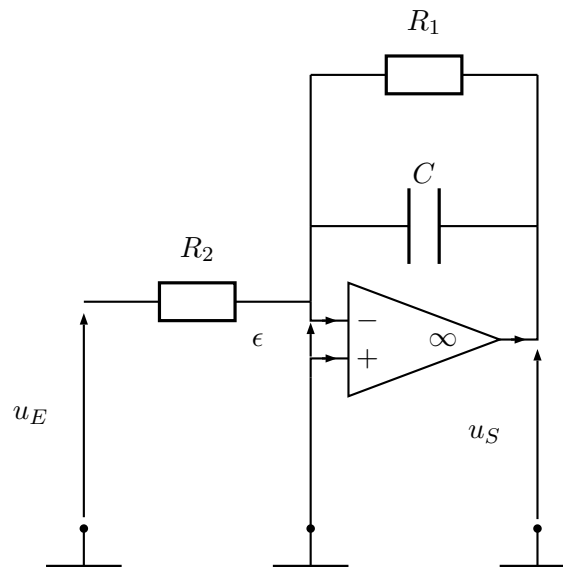
## 1.5 Examples



```

1 \begin{pspicture}(-1.5,-1)(6,5)
2 % \psgrid[subgriddiv=1,griddots=10]
3 % Node definitions
4 \pnode(0,0){A}
5 \pnode(0,3){B}
6 \pnode(4.5,3){C}
7 \pnode(4.5,0){D}
8 % Dipole node connection
9 \Ucc[tension,dipoleconvention=generator](A)(B){$E$}
10 \multidipole(B)(C)%
11 \switch[intensitylabel=$i$]{$K$}%
12 \resistor[labeloffset=0,tensionlabel=$u_R$]{$R$}.
13 \capacitor[tensionlabel={$u_C$},
14 tensionlabeloffset=-1.2,tensionoffset=-1,
15 directconvention=false](D)(C){$C$}
16 % Wire to complete circuit
17 \wire(A)(D)
18 % Ground
19 \ground(D)
20 \end{pspicture}

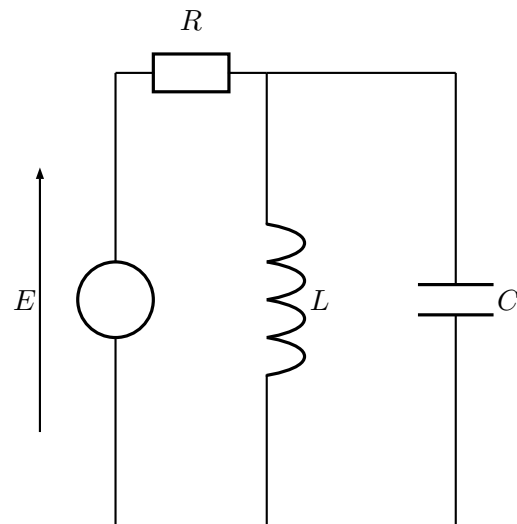
```



```

1 \begin{pspicture}(-0.5,0)(7,8)
2 % \psgrid[subgriddiv=1,griddots=10]
3 % Node definitions
4 \pnode(0.5,1){A}
5 \pnode(3.5,1){B}
6 \pnode(6.5,1){C}
7 \pnode(0.5,4){D}
8 \pnode(3.5,4){Minus}
9 \pnode(3.5,3){Plus}
10 \pnode(6.5,5){S}
11 \pnode(3.5,5){E}
12 % Dipole node connections
13 \resistor(D)(Minus){$R_2$}
14 \capacitor(E)(S){$C$}
15 \resistor[parallel,parallelarm=2](E)(S){$R_1$}
16 \OA[intensity](Minus)(Plus)(S)
17 % Wires
18 \wire(Minus)(E)
19 \wire(Plus)(B)
20 % Tensions
21 \tension(A)(D){$u_E$}
22 \makeatletter % (special tricks see below)
23 \tension(C)(S@@){$u_S$}
24 \tension[linecolor=blue](Plus@@)(Minus@@){$\epsilon$}
25 \makeatother
26 % Grounds
27 \ground(A)
28 \ground(B)
29 \ground(C)
30 \end{pspicture}

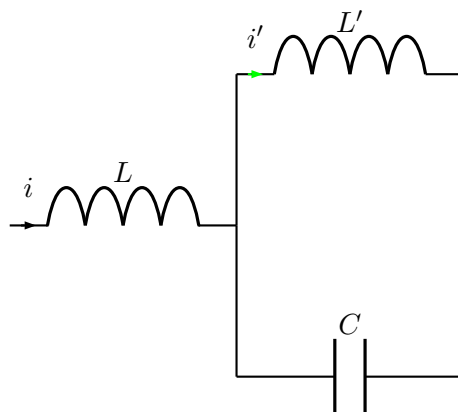
```



```

1 \begin{pspicture}(-1,0)(7,8)
2 % \psgrid[subgriddiv=1,griddots=10]
3 % Node definitions
4 \pnode(1,1){A}
5 \pnode(1,7){B}
6 \pnode(3,1){C}
7 \pnode(3,7){D}
8 % Dipole node connections
9 \Ucc[tensionlabel=$E$](A)(B){}
10 \resistor(B)(D){$R$}
11 \coil(D)(C){$L$}
12 \capacitor[parallel,parallelarm=2.5](D)(C){$C$}
13 % Wire
14 \wire(A)(C)
15 \end{pspicture}

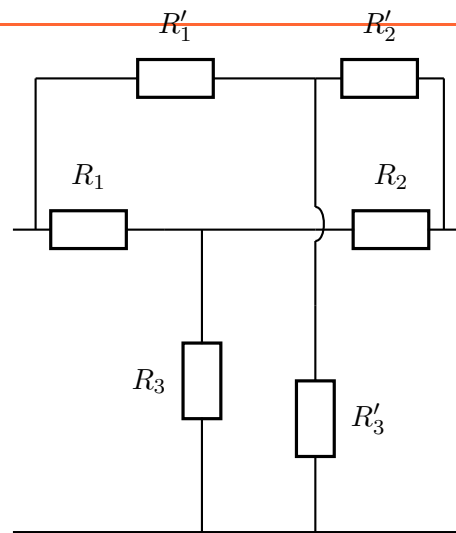
```



```

1 \begin{pspicture}(-0.25,-0.25)
2 (6,6)
3 % \psgrid[subgriddiv=1,griddots
4 =10]
5 % Node definitions
6 \pnode(0,3){A}
7 \pnode(3,3){B}
8 \pnode(6,3){C}
9 % Dipole node connections
10 \coil[intensitylabel=$i$](A)(B)
11 {$L$}
12 \coil[intensitylabel=$i'$,
13 intensitycolor=green,%
14 parallel,parallelarm=2](B)(C)
15 {$L'$}
16 \capacitor[parallel,parallelarm
17 =-2](B)(C){$C$}
18 \end{pspicture}

```

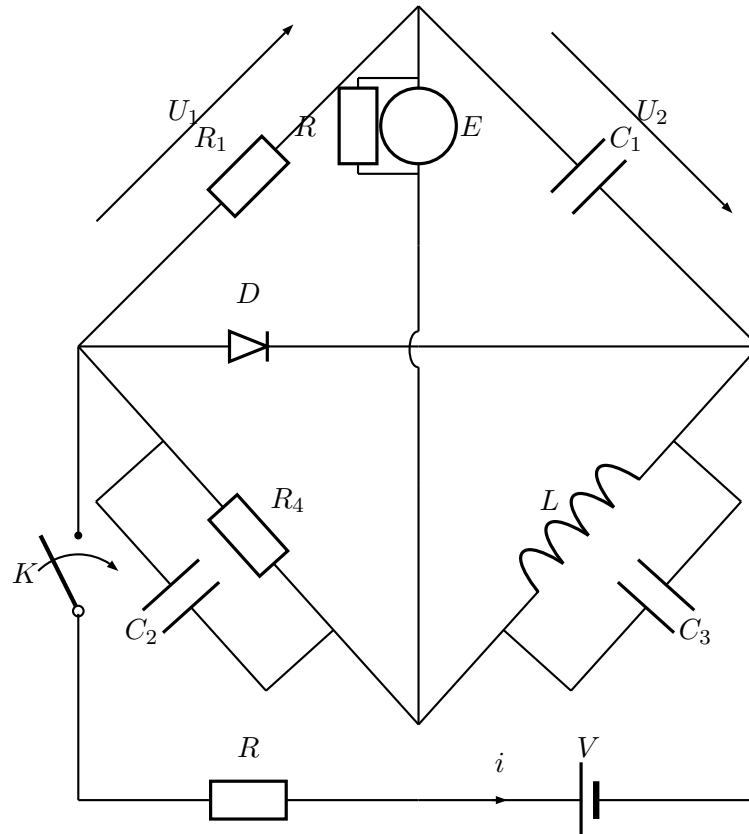


```

1 \begin{pspicture}(6,6)
2 % \psgrid[subgriddiv=1,griddots=10]
3 % Node definitions
4 \pnode(0,0){A}\pnode(6,0){B}
5 \pnode(0.3,4){Cprime}\pnode(5.7,4){Dprime}
6 \pnode(2.5,4){Gprime}\pnode(2.5,0){Hprime}
7 \pnode(0,4){C}\pnode(6,4){D}
8 \pnode(0.3,6){E}\pnode(5.7,6){F}
9 \pnode(4,6){G}\pnode(4,0){H}
10 \multidipole(G)(H)%
11 \wire[intersect,
12 intersectA=C,intersectB=D]
13 \resistor{$R'_3$}.
14 \resistor(E)(G){$R'_1$}
15 \resistor(G)(F){$R'_2$}
16 \multidipole(C)(D)\resistor{$R_1$}%
17 \wire\resistor{$R_2$}.
18 \wire(A)(B)\wire(Cprime)(E)
19 \wire(Dprime)(F)
20 \resistor(Hprime)(Gprime){$R_3$}
21 \end{pspicture}

```

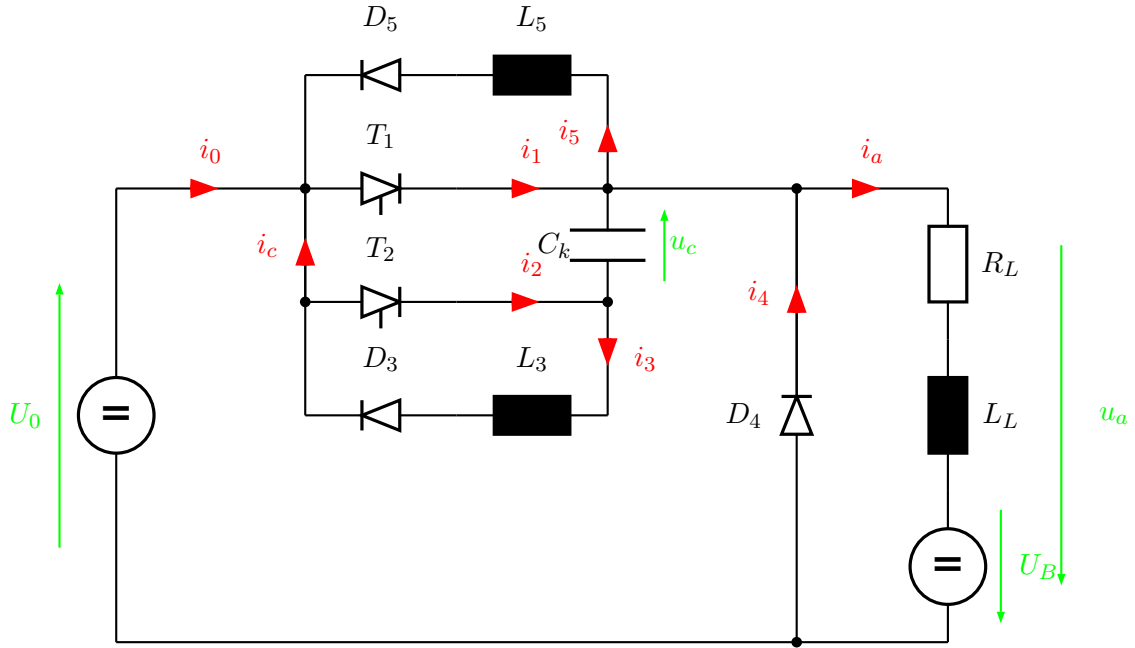




```

1 \begin{pspicture}(0,-0.25)(9,11)
2 % Node definitions
3 \pnode(0,0){A}\pnode(9,0){B}\pnode(0,6){C}\pnode(9,6){D}\pnode(4.5,1){E}\pnode
4 (4.5,10.5){F}
5 %
6 \switch(A)(C){$K$}
7 \multidipole(A)(B)\resistor{$R$}\battery[intensitylabel=$i$]{$V$}.
8 \wire(B)(D)
9 \multidipole(C)(D)\diode{$D$}\wire.
10 \resistor[tensionlabel=$U_1$](C)(F){$R_1$} \resistor(C)(E){$R_4$}
11 \capacitor[parallel,parallellarm=1.2,parallelsep=1.5](C)(E){$C_2$}
12 \coil(E)(D){$L$}
13 \capacitor[parallel,parallellarm=1.2,parallelsep=1.5](E)(D){$C_3$}
14 \capacitor[tensionlabel=$U_2$](F)(D){$C_1$}
15 \multidipole(E)(F)\wire\wire[intersect,intersectA=C,intersectB=D]%
16 \circledipole[labeloffset=-0.7]{$E$}%
17 \resistor[parallel,parallelsep=.6,parallellarm=.8]{$R$}.
18 \end{pspicture}

```

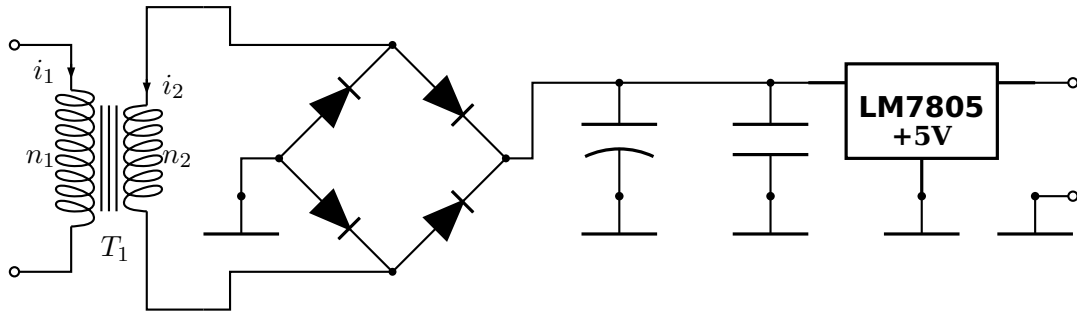


```

1 \begin{pspicture}(0,-0.2)(13,8)
2 \psset{intensitycolor=red,intensitylabelcolor=red,tensioncolor=green,
3 tensionlabelcolor=green,intensitywidth=3pt}
4 \circledipole[tension,tensionlabel=$U_0$,
5 tensionoffset=0.75,labeloffset=0](0,0)(0,6){\LARGE\textbf{=}}
6 \wire[intensity,intensitylabel=$i_0$](0,6)(2.5,6)
7 \diode[dipolestyle=thyristor](2.5,6)(4.5,6){$T_1$}
8 \wire[intensity,intensitylabel=$i_1$](4.5,6)(6.5,6)
9 \multidipole(6.5,7.5)(2.5,7.5)%
10 \coil[dipolestyle=rectangle,labeloffset=-0.75]{$L_5$}%
11 \diode[labeloffset=-0.75]{$D_5$}.
12 \wire[intensity,intensitylabel=$i_5$](6.5,6)(6.5,7.5)
13 \wire(2.5,7.5)(2.5,3)
14 \wire[intensity,intensitylabel=$i_c$](2.5,4.5)(2.5,6)
15 \qdisk(2.5,6){2pt}\qdisk(6.5,6){2pt}
16 \diode[dipolestyle=thyristor](2.5,4.5)(4.5,4.5){$T_2$}
17 \wire[intensity,intensitylabel=$i_2$](4.5,4.5)(6.5,4.5)
18 \capacitor[tension,tensionlabel=$u_c$,tensionoffset=-0.75,
19 tensionlabeloffset=-1](6.5,4.5)(6.5,6){$C_k$}
20 \qdisk(2.5,4.5){2pt}\qdisk(6.5,4.5){2pt}
21 \wire[intensity,intensitylabel=$i_3$](6.5,4.5)(6.5,3)
22 \multidipole(6.5,3)(2.5,3)%
23 \coil[dipolestyle=rectangle,labeloffset=-0.75]{$L_3$}%
24 \diode[labeloffset=-0.75]{$D_3$}.
25 \wire(6.5,6)(9,6)\qdisk(9,6){2pt}
26 \diode(9,0)(9,6){$D_4$}
27 \wire[intensity,intensitylabel=$i_4$](9,3.25)(9,6)
28 \wire[intensity,intensitylabel=$i_a$](9,6)(11,6)
29 \multidipole(11,6)(11,0)%
30 \resistor{$R_L$}
31 \coil[dipolestyle=rectangle]{$L_L$}
32 \circledipole[labeloffset=0,tension,tensionoffset=0.7,tensionlabel=$U_B$]{\LARGE\textbf{=}}.
33 \wire(0,0)(11,0)\qdisk(9,0){2pt}
34 \pnode(12.5,5.5){A}\pnode(12.5,0.5){B}
35 \tension(A)(B){$u_a$}
36 \end{pspicture}

```

The following example was written by Manuel Luque.

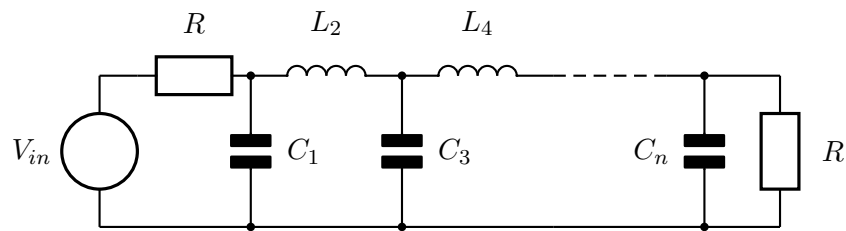


```

1 \begin{pspicture}(0,-0.5)(14,4)
2 % \psgrid[subgriddiv=1,griddots=10]
3 \pnode(0,0){B}\pnode(0,3){A}
4 \pnode(2.5,3.5){C}\pnode(2.5,-0.5){D}\pnode(5,3){E}\pnode(6.5,1.5){F}
5 \pnode(5,0){G}\pnode(3.5,1.5){H} \pnode(8,2.5){I}\pnode(8,1){J}
6 \pnode(10,2.5){K}\pnode(10,1){L} \pnode(14,2.5){M}\pnode(12,1){N}
7 \pnode(3,1){H'}\pnode(14,2.5){O} \pnode(14,1){P}\pnode(13.5,1){Q}
8 \transformer[transformerprimarylabel=$i_1$,transformerissecondarylabel=$i_2$,
9   primarylabel=$n_1$,secondarylabel=$n_2$](A)(B)(C)(D){$T_1$}
10 {\psset{fillstyle=solid,fillcolor=black}
11 \diode(H)(E){}\diode(H)(G){} \diode(E)(F){}\diode(G)(F){}
12 \capacitor[dipolestyle=chemical](I)(J){} \capacitor(K)(L){}
13 \REG(K)(M)(N)%
14   {\shortstack{\textsf{%
15     \textbf{\large LM7805}}\textbf{+5V}}}}
16 \ncangle{I}{F}\psline(I)(K) \ncangle{E}{C}\ncangle{G}{D}
17 \ncangle[arm=0]{P}{Q} \ncangle[arm=0]{H}{H'}
18 \ground(H')\ground(J)\ground(L)\ground(N)
19 \ground(Q)\qdisk(I){1.5pt}\qdisk(K){1.5pt}\qdisk(E){1.5pt}
20 \qdisk(G){1.5pt}\qdisk(H){1.5pt}\qdisk(F){1.5pt}
21 \pscircle[fillstyle=solid](A){0.075} \pscircle[fillstyle=solid](B){0.075}
22 \pscircle[fillstyle=solid](P){0.075} \pscircle[fillstyle=solid](O){0.075}
23 \end{pspicture}

```

The following example was written by Lionel Cordesses.

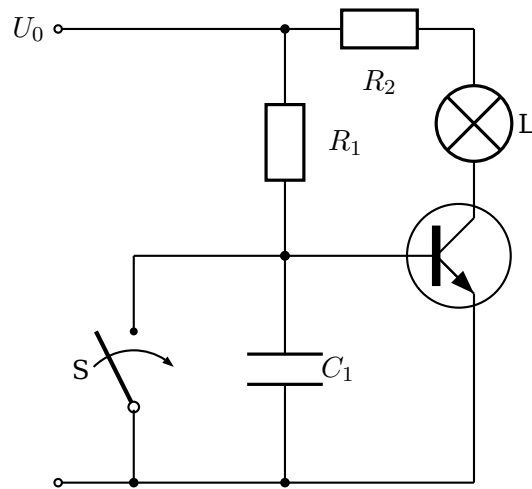


```

1 \begin{pspicture}(11,3)
2 \psset{dipolestyle=elektor}
3 \pnode(1,2){Vin}\pnode(0.5,2){S}\pnode(0.5,0){Sm}
4 \pnode(2.5,2){A}\pnode(4.5,2){B}\pnode(6.5,2){C}
5 \pnode(8,2){Cd}\pnode(8.5,2){D}\pnode(9.5,2){E}
6 \pnode(2.5,0){Am}\pnode(4.5,0){Bm}\pnode(6.5,0){Cm}
7 \pnode(8.5,0){Dm}\pnode(9.5,0){Em}
8 \Ucc[labeloffset=0.9](Sm)(S){$V_{in}$}\resistor(Vin)(A){$R$}
9 \capacitor(A)(Am){$C_1$}\capacitor(B)(Bm){$C_3$}
10 \capacitor[labeloffset=-0.7](D)(Dm){$C_n$}\resistor(E)(Em){$R$}
11 \coil(A)(B){$L_2$}\coil(B)(C){$L_4$}
12 \wire(Am)(Bm)\wire(Bm)(Cm)\wire(Cm)(Dm)\wire(Dm)(Em)\wire(D)(E)
13 \wire(Cd)(D)\psline[linestyle=dashed](C)(Cd)
14 \wire(S)(Vin)\wire(Sm)(Am)
15 \pscircle*(D){2\pslinewidth}\pscircle*(Dm){2\pslinewidth}
16 \pscircle*(A){2\pslinewidth}\pscircle*(Am){2\pslinewidth}
17 \pscircle*(B){2\pslinewidth}\pscircle*(Bm){2\pslinewidth}
18 \end{pspicture}

```

The following example was written by Christian Hoffmann.



```

1 \SpecialCoor
2 \begin{pspicture}(0,-1)(7,6.5)%\psgrid
3 \pnode(0,6){plus}
4 \pnode(3,3){basis}
5 \pnode([nodesep=-2] basis){schalter}
6 \pnode(0,0){masse}
7 \wire[arrows=o-*)(plus)(basis|plus)
8 \uput[l](plus){$U_0$}
9 \resistor[labeloffset=.8](basis|plus)(basis){$R_1$}
10 \transistor[basesep=2cm](basis){emitter}{kollektor}
11 \wire[arrows=-*)(schalter)(basis)
12 % \wire(basis)([nodesep=2] basis)
13 \wire(TBaseNode)(basis)
14 \switch(schalter|masse)(schalter){S}
15 \lamp(kollektor|plus)(kollektor){L}
16 \resistor(kollektor|plus)(basis|plus){$R_2$}
17 \wire(emitter)(emitter|masse)
18 \wire(emitter|masse)(basis|masse)
19 \capacitor(basis)(basis|masse){$C_1$}
20 \wire[arrows=-*)(basis|masse)(schalter|masse)
21 \wire[arrows=-o*)(schalter|masse)(masse)
22 \end{pspicture}

```

## 2 Microwave symbols

Since for microwave signal, the direction in which the signal spreads is very important, There are dipoleinput or tripoleinput or quadripoleinput and arrowinput parameters. The value of theses parameters are left or right for the first one and true or false for second one.

```

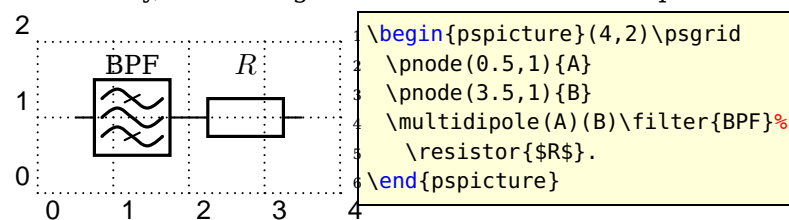
1 \ifPst@inputarrow
2   \ifx\psk@Dinput\pst@Dinput@right
3     \pcline[arrows=-C](#2)(dipole@1)
4     \pcline[arrows=->,arrowinset=0](#3)(dipole@2)
5   \else
6     \pcline[arrows=->,arrowinset=0](#2)(dipole@1)
7     \pcline[arrows=C-](dipole@2)(#3)
8   \fi
9 \else
10  \pcline[arrows=-C](#2)(dipole@1)
11  \pcline[arrows=C-](dipole@2)(#3)
12 \fi
13 \pcline[fillstyle=none,linestyle=none](#2)(#3)

```

The last line is to correct somme problems when I use colors (see example2)

To add color in components (Monopole, tripole and Quadripole) I add a new argument since I don't know how to do this by another way. However, I think it is not the optimal solution. For dipole, to put commands for color in the first optionnal argument is ok.

Finally, something doesn't work with multidipole: this following example works:



However, this following one doesn't work:

```

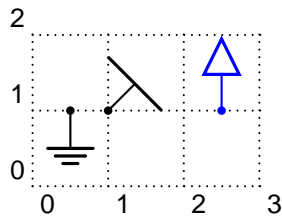
\begin{pspicture}(4,2)\psgrid
\pnode(0.5,1){A}
\pnode(3.5,1){B}
\multidipole(A)(B)\amplifier{LNA}%
\resistor{$R$}.
\end{pspicture}

```

### 2.1 New monopole components

#### New ground

*groundstyle*: ads | old | triangle



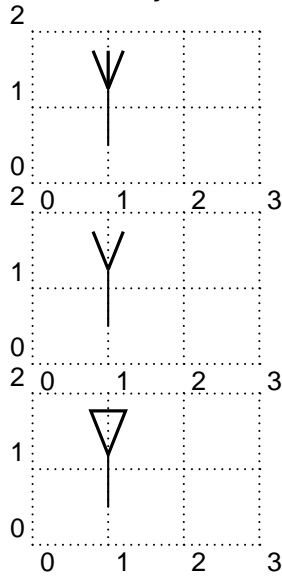
```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0.5,1){A}
3   \node(1,1){B}
4   \node(2.5,1){C}
5   \newground(A)
6   \newground[groundstyle=old]{135}(B)
7   \newground[linecolor=blue,groundstyle=triangle]{180}(C)
8 \end{pspicture}

```

### Antenna

*antennastyle*: two | three | triangle



```

1 \begin{pspicture}(3,2)\psgrid
2   \node(1,0.5){A}
3   \antenna[antennastyle=three](A)
4 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(1,0.5){A}
3   \antenna(A)
4 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(1,0.5){A}
3   \antenna[antennastyle=triangle](A)
4 \end{pspicture}

```

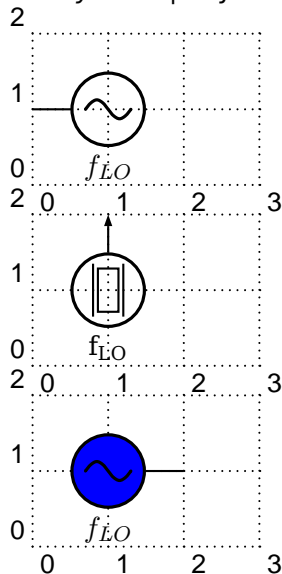
## 2.2 New monopole macro-components

### Oscillator

*output*: top | right | bottom | left

*inputarrow*: false | true

*L0style*: - | crystal



```

1 \begin{pspicture}(3,2)\psgrid
2   \node(1,1){A}
3   \oscillator[output=left,inputarrow=false](A)%
4     {$f_{LO}$}{}
5 \end{pspicture}

```

```

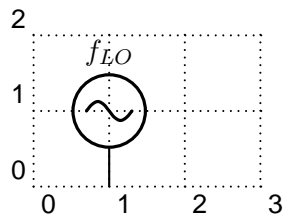
1 \begin{pspicture}(3,2)\psgrid
2   \node(1,1){A}
3   \oscillator[output=top,inputarrow=true,L0style=crystal](A)%
4     {f$_{\text{crystal}}$}{}
5 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(1,1){A}
3   \oscillator[output=right,inputarrow=false](A)%
4     {$f_{LO}$}{fillstyle=solid,fillcolor=blue}
5 \end{pspicture}

```



```

1 \begin{pspicture}(3,2)\psgrid
2   \nnode(1,1){A}
3   \oscillator[output=bottom,inputarrow=false](A){%
4     {$f_{LO}$}}
5 \end{pspicture}

```

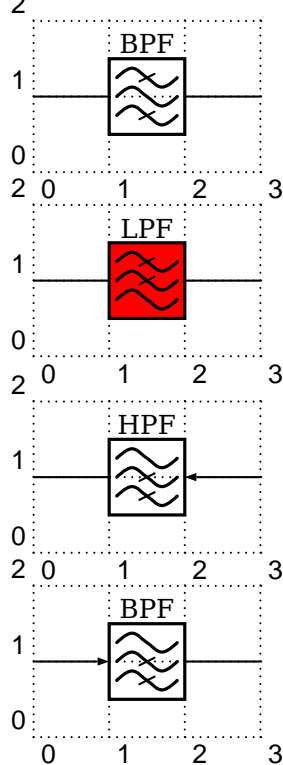
## 2.3 New dipole macro-components

### Filters

*dipolestyle*: bandpass | lowpass | highpass

*inputarrow*: false | true

*dipoleinput*: left | right



```

1 \begin{pspicture}(3,2)\psgrid
2   \nnode(0,1){A}
3   \nnode(3,1){B}
4   \filter(A)(B){BPF}
5 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \nnode(0,1){A}
3   \nnode(3,1){B}
4   \filter[dipolestyle=lowpass,fillstyle=solid,%
5     fillcolor=red](A)(B){LPF}
6 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \nnode(0,1){A}
3   \nnode(3,1){B}
4   \filter[dipolestyle=highpass,dipoleinput=right,%
5     inputarrow=true](A)(B){HPF}
6 \end{pspicture}

```

```

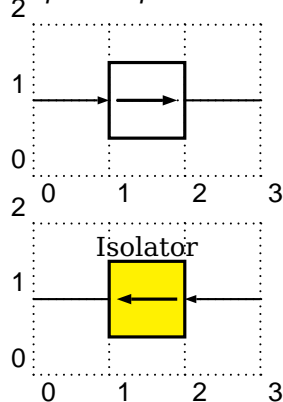
1 \begin{pspicture}(3,2)\psgrid
2   \nnode(0,1){A}
3   \nnode(3,1){B}
4   \filter[dipolestyle=highpass,inputarrow=true](A)(B){BPF}
5 \end{pspicture}

```

### Isolator

*inputarrow*: false | true

*dipoleinput*: left | right



```

1 \begin{pspicture}(3,2)\psgrid
2   \nnode(0,1){A}
3   \nnode(3,1){B}
4   \isolator[inputarrow=true](A)(B){}
5 \end{pspicture}

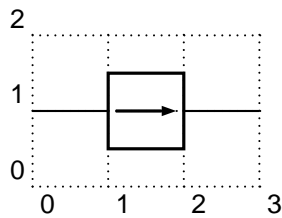
```

```

1 \begin{pspicture}(3,2)\psgrid
2   \nnode(0,1){A}
3   \nnode(3,1){B}
4   \isolator[dipoleinput=right,inputarrow=true,fillstyle=solid,%
5     fillcolor=yellow](A)(B){Isolator}
6 \end{pspicture}

```





```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \isolator[dipoleinput=left](A)(B){}
5 \end{pspicture}

```

### Frequency multiplier/divider

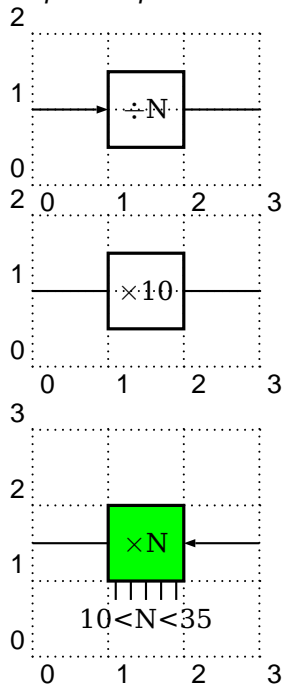
*dipolestyle*: multiplier | divider

*value*:  $N \mid n \in \mathbb{N}$

*programmable*: false | true

*inputarrow*: false | true

*dipoleinput*: left | right



```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \freqmult[dipolestyle=divider,inputarrow=true](A)(B){}
5 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \freqmult[dipolestyle=multiplier,value=10](A)(B){}
5 \end{pspicture}

```

```

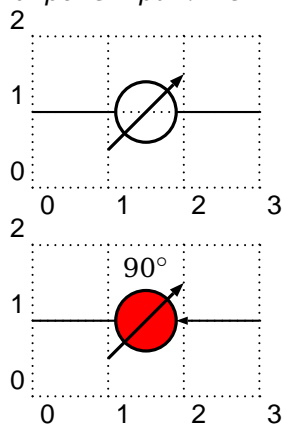
1 \begin{pspicture}(3,3)\psgrid
2   \node(0,1.5){A}
3   \node(3,1.5){B}
4   \freqmult[dipolestyle=multiplier,programmable=true,%
5             labeloffset=-1,%
6             dipoleinput=right,%
7             inputarrow=true,
8             fillstyle=solid,
9             fillcolor=green](A)(B){10<N<35}
10 \end{pspicture}

```

### Phase shifter

*inputarrow*: false | true

*dipoleinput*: left | right



```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A1}
3   \node(3,1){A2}
4   \phaseshifter(A1)(A2){}
5 \end{pspicture}

```

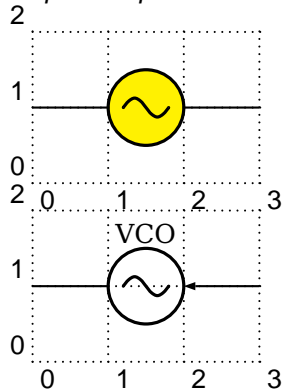
```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){B1}
3   \node(3,1){B2}
4   \phaseshifter[inputarrow=true,%
5                 dipoleinput=right,fillstyle=solid,fillcolor=red]%
6                 (B1)(B2){90\ensuremath{\circ}\circ}
7 \end{pspicture}

```

**VCO**

*inputarrow*: false| true  
*dipoleinput*: left| right



```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A1}
3   \node(3,1){A2}
4   \vco[fillstyle=solid,fillcolor=yellow](A1)(A2){}
5 \end{pspicture}

```

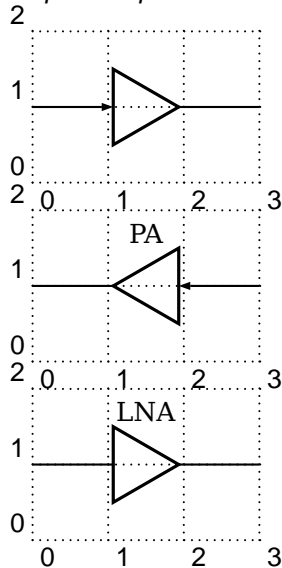
```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){B1}
3   \node(3,1){B2}
4   \vco[dipoleinput=right,inputarrow=true](B1)(B2){VCO}
5 \end{pspicture}

```

**Amplifier**

*inputarrow*: false| true  
*dipoleinput*: left| right



```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \amplifier[inputarrow=true](A)(B){}
5 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \amplifier[dipoleinput=right,inputarrow=true](A)(B){PA}
5 \end{pspicture}

```

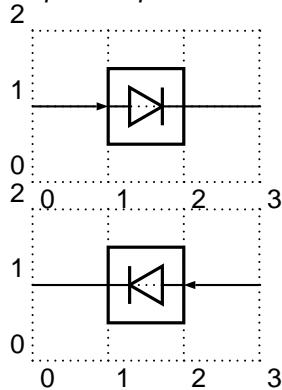
```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \amplifier[dipoleinput=left](A)(B){LNA}
5 \end{pspicture}

```

**Detector**

*inputarrow*: false| true  
*dipoleinput*: left| right



```

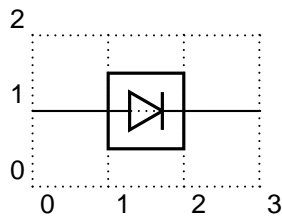
1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \detector[inputarrow=true](A)(B){}
5 \end{pspicture}

```

```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \detector[dipoleinput=right,inputarrow=true](A)(B){}
5 \end{pspicture}

```



```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1){A}
3   \node(3,1){B}
4   \detector[dipoleinput=left](A)(B){}
5 \end{pspicture}

```

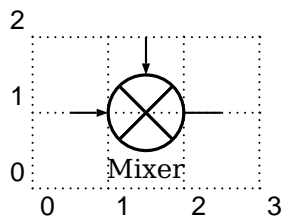
## 2.4 New tripole macro-components

### Mixer

*tripolestyle*: bottom | top

*tripoleconfig*: left | right

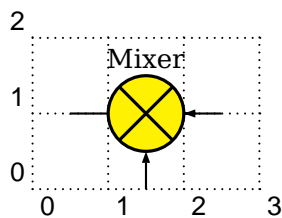
*inputarrow*: false | true



```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0.5,1){A}
3   \node(2.5,1){B}
4   \node(1.5,2){C}
5   \mixer[tripolestyle=top,inputarrow=true](A)(B)(C)%
6     {Mixer}{}
7 \end{pspicture}

```



```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0.5,1){A}
3   \node(2.5,1){B}
4   \node(1.5,0){C}
5   \mixer[inputarrow=true,tripoleinput=right](A)(B)(C)%
6     {Mixer}{fillstyle=solid,fillcolor=yellow}
7 \end{pspicture}

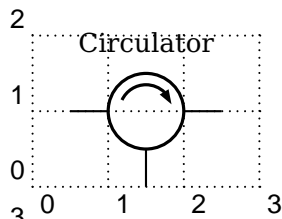
```

### Circulator

*tripolestyle*: circulator | isolator

*inputarrow*: false | true

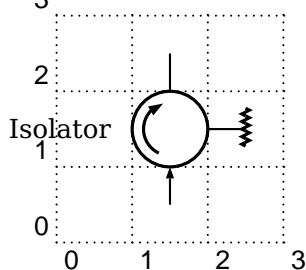
*tripoleinput*: left | right



```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0.5,1){A}
3   \node(2.5,1){B}
4   \node(1.5,0){C}
5   \circulator{0}(A)(B)(C){Circulator}{}
6 \end{pspicture}

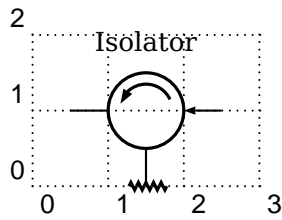
```



```

1 \begin{pspicture}(3,3)\psgrid
2   \node(1.5,0.5){A}
3   \node(1.5,2.5){B}
4   \node(0.5,1.5){C}
5   \circulator[tripolestyle=isolator,inputarrow=true]{90}%
6     (A)(B)(C){Isolator}{}
7 \end{pspicture}

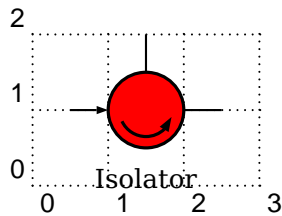
```



```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0.5,1){A}
3   \node(2.5,1){B}
4   \node(1.5,0){C}
5   \circulator[tripoleconfig=right,tripolestyle=isolator,%
6     inputarrow=true,tripoleinput=right]{0}%
7     (B)(A)(C){Isolator}{}
8 \end{pspicture}

```



```

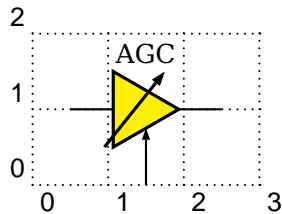
1 \begin{pspicture}(3,2)\psgrid
2   \node(0.5,1){A}
3   \node(2.5,1){B}
4   \node(1.5,2){C}
5   \circulator[tripoleconfig=right,inputarrow=true]{180}%
6     (A)(B)(C){Isolator}{fillstyle=solid,fillcolor=red}
7 \end{pspicture}

```

### Agc

*inputarrow*: false | true

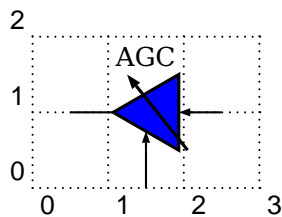
*tripoleinput*: left | right



```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0.5,1){A}
3   \node(2.5,1){B}
4   \node(1.5,0){C}
5   \agc(A)(B)(C){AGC}{fillstyle=solid,fillcolor=yellow}
6 \end{pspicture}

```



```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0.5,1){A}
3   \node(2.5,1){B}
4   \node(1.5,0){C}
5   \agc[tripoleinput=right,inputarrow=true](A)(B)(C)%
6     {AGC}{fillstyle=solid,fillcolor=blue}
7 \end{pspicture}

```

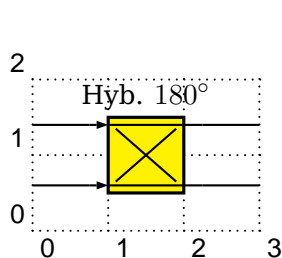
## 2.5 New quadripole macro-components

### Coupler

*couplerstyle*: hybrid | directional

*inputarrow*: false | true

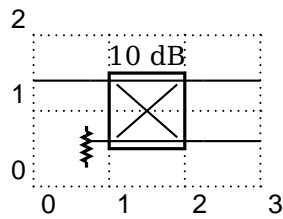
*quadripoleinput*: left | right



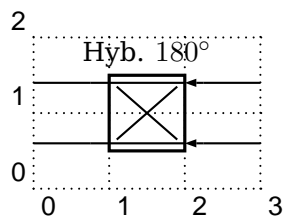
```

1 \begin{pspicture}(3,2)\psgrid
2   \node(0,1.4){A}
3   \node(0,0.6){B}
4   \node(3,1.4){C}
5   \node(3,0.6){D}
6   \coupler[couplerstyle=hybrid,inputarrow=true](A)(B)(C)(D)%
7     {Hyb. $180^\circ$ \ensuremath{\circ}}%
8     {fillstyle=solid,fillcolor=yellow}
9 \end{pspicture}

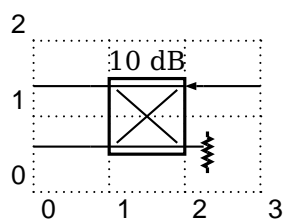
```



```
\begin{pspicture}(3,2)\psgrid
\pnode(0,1.4){A}
\pnode(0,0.6){B}
\pnode(3,1.4){C}
\pnode(3,0.6){D}
\coupler[couplerstyle=directional](A)(B)(C)(D){10~dB}{ }
\end{pspicture}
```



```
\begin{pspicture}(3,2)\psgrid
\pnode(0,1.4){A}
\pnode(0,0.6){B}
\pnode(3,1.4){C}
\pnode(3,0.6){D}
\coupler[couplerstyle=hybrid,inputarrow=true,%
quadripoleinput=right](A)(B)(C)(D)%
{Hyb.  $180^\circ$  \ensuremath{\circ}}{}
\end{pspicture}
```

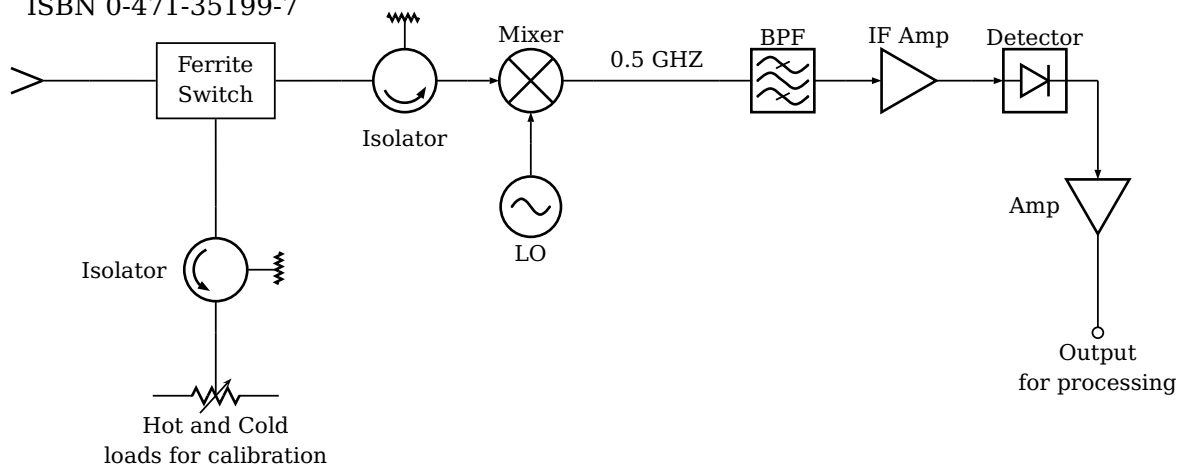


```
\begin{pspicture}(3,2)\psgrid
\pnode(0,1.4){A}
\pnode(0,0.6){B}
\pnode(3,1.4){C}
\pnode(3,0.6){D}
\coupler[couplerstyle=directional,quadripoleinput=right,%
inputarrow=true](A)(B)(C)(D){10~dB}{ }
\end{pspicture}
```

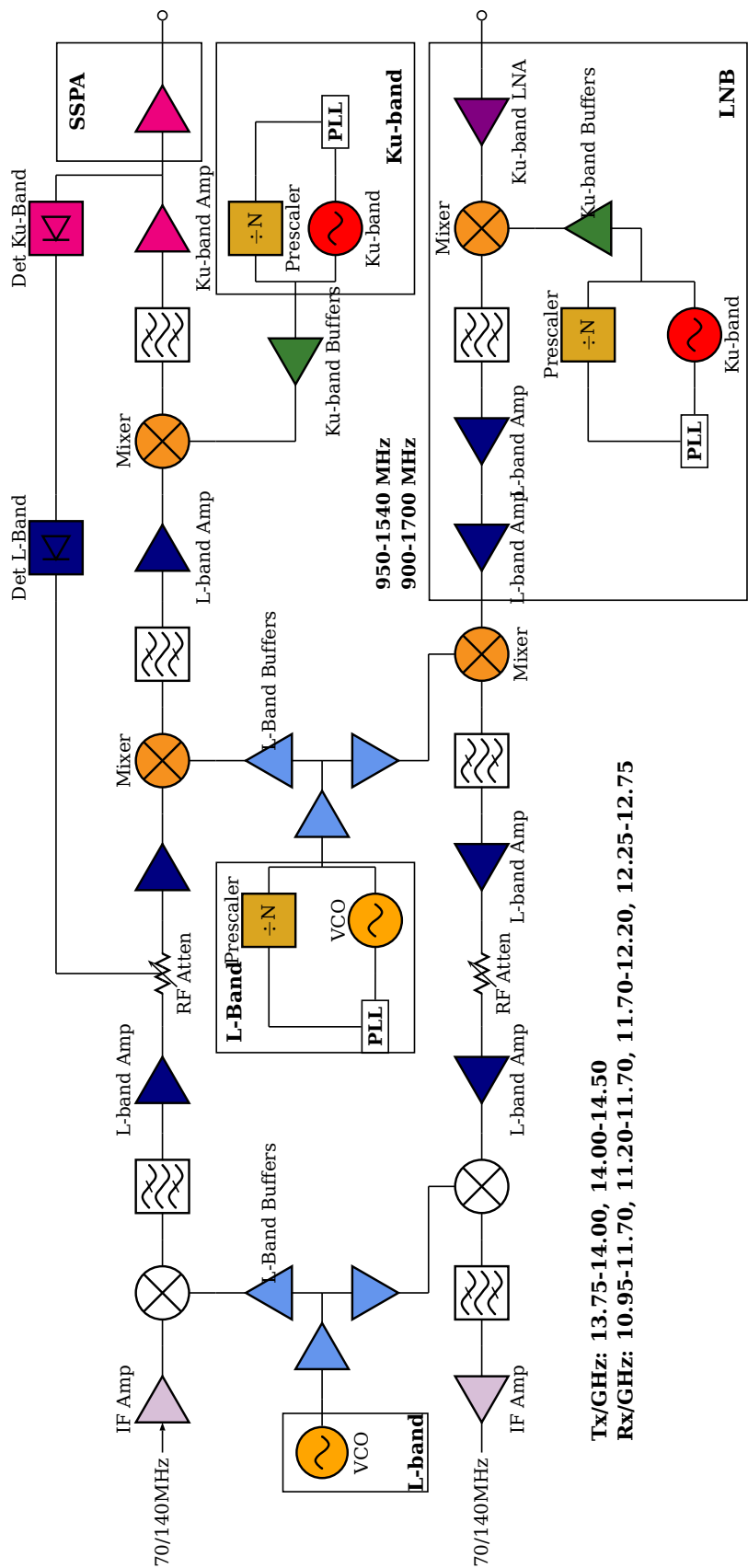
## 2.6 Examples

### Radiometer block diagram example

From Chang, K., RF and Microwave Wireless Systems, Wiley InterScience, page 319, ISBN 0-471-35199-7



**Ku-band Transceiver**



**Tx/GHz: 13.75-14.00, 14.00-14.50**  
**Rx/GHz: 10.95-11.70, 11.20-11.70, 11.70-12.20, 12.25-12.75**

### 3 Flip Flops – logical elements

The syntax for all logical base circuits is

```
\logic [Options] (x0, y0) {label}
```

where the options and the origin are optional. If they are missing, then the default options, described in the next section and the default origin (0,0) is used. The origin specifies the lower left corner of the logical circuit.

xLkeywordlogicType

```
1 \logic{Demo}
2 \logic[logicType=and]{Demo}
3 \logic(0,0){Demo}
4 \logic[logicType=and](0,0){Demo}
```

The above four „different“ calls of the \logic macro give the same output, because they are equivalent.

#### 3.1 The Options

<i>name</i>	<i>type</i>	<i>default</i>
logicShowNode	boolean	false
logicShowDot	boolean	false
logicNodestyle	command	\footnotesize
logicSymbolstyle	command	\large
logicSymbolpos	value	0.5
logicLabelstyle	command	\small
logicType	string	and
logicChangeLR	boolean	false
logicWidth	length	1.5
logicHeight	length	2.5
logicWireLength	length	0.5
logicNInput	number	2
logicJInput	number	2
logicKInput	number	2

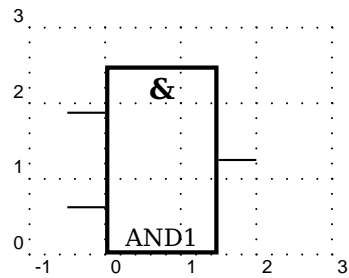
#### 3.2 Basic Logical Circuits

At least the basic objects require a unique label name, otherwise it is not sure, that all nodes will work well. The label may contain any alphanumerical character and most of all symbols. But it is save using only combinations of letters and digits. For example:

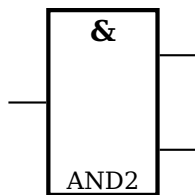
```
And0
a0
a123
12
NOT123a
```

A\_1 is not a good choice, the underscore may cause some problems.

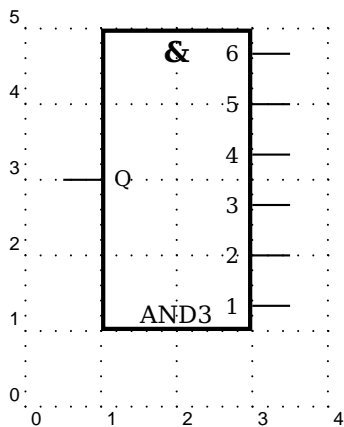
### And



```
\begin{pspicture}(-1,0)(3,3)
\psgrid
\logic{AND1}
\end{pspicture}
```

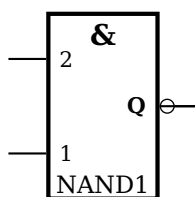


```
\begin{pspicture}(-0.5,0)(3,3)
\logic[logicChangeLR=true]{AND2}
\end{pspicture}
```

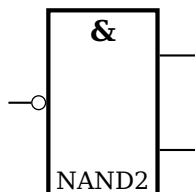


```
\begin{pspicture}(-0.5,0)(4,5)
\psgrid
\logic[logicShowNode=true,%
logicWidth=2,%
logicHeight=4,%
logicNInput=6,%
logicChangeLR=true](1,1){AND3}
\end{pspicture}
```

### NotAnd

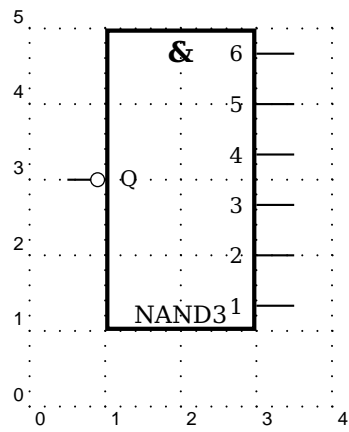


```
\begin{pspicture}(-0.5,0)(3,3)
\logic[logicType=nand,%
logicShowNode=true]{NAND1}
\end{pspicture}
```



```
\begin{pspicture}(-0.5,0)(3,3)
\logic[logicType=nand,%
logicChangeLR=true]{NAND2}
\end{pspicture}
```



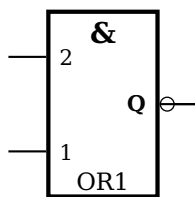


```

\begin{pspicture}(4,5)
\psgrid
\logic[logicType=nand,%
  logicShowNode=true,%
  logicWidth=2,%
  logicHeight=4,%
  logicNInput=6,%
  logicChangeLR=true](1,1){NAND3}
\end{pspicture}

```

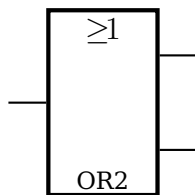
Or



```

\begin{pspicture}(-0.5,0)(3,3)
\logic[logicType=or,%
  logicShowNode=true]{OR1}
\end{pspicture}

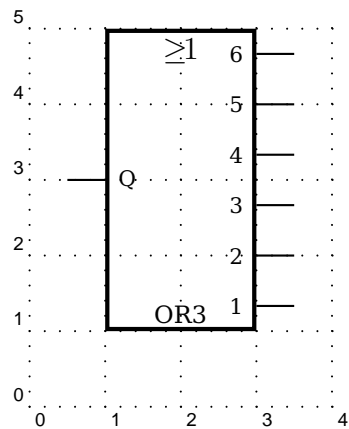
```



```

\begin{pspicture}(-0.5,0)(3,3)
\logic[logicType=or,%
  logicChangeLR=true]{OR2}
\end{pspicture}

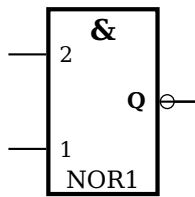
```



```

\begin{pspicture}(4,5)
\psgrid
\logic[logicType=or,%
  logicShowNode=true,%
  logicWidth=2,%
  logicHeight=4,%
  logicNInput=6,%
  logicChangeLR=true](1,1){OR3}
\end{pspicture}

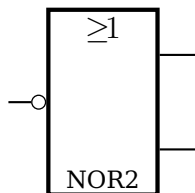
```

**Not Or**

```

1 \begin{pspicture}(-0.5,0)(3,3)
2 \logic[logicType=nor,%
3   logicShowNode=true]{NOR1}
4 \end{pspicture}

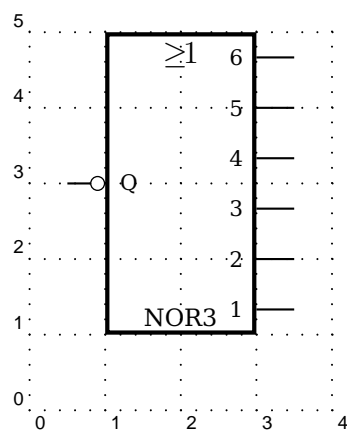
```



```

1 \begin{pspicture}(-0.5,0)(3,3)
2 \logic[logicType=nor,%
3   logicChangeLR=true]{NOR2}
4 \end{pspicture}

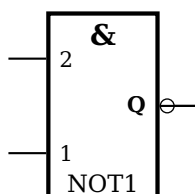
```



```

1 \begin{pspicture}(4,5)
2 \psgrid
3 \logic[logicType=nor,%
4   logicShowNode=true,%
5   logicWidth=2,%
6   logicHeight=4,%
7   logicNInput=6,%
8   logicChangeLR=true](1,1){NOR3}
9 \end{pspicture}

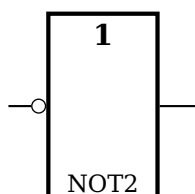
```

**Not**

```

1 \begin{pspicture}(-0.5,0)(3,3)
2 \logic[logicType=not,%
3   logicShowNode=true]{NOT1}
4 \end{pspicture}

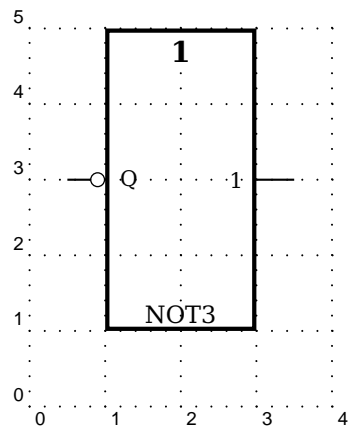
```



```

1 \begin{pspicture}(-0.5,0)(3,3)
2 \logic[logicType=not,%
3   logicChangeLR=true]{NOT2}
4 \end{pspicture}

```

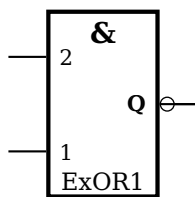


```

\begin{pspicture}(4,5)
\psgrid
\logic[logicType=not,%
      logicShowNode=true,%
      logicWidth=2,%
      logicHeight=4,%
      logicChangeLR=true](1,1){NOT3}
\end{pspicture}

```

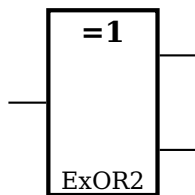
### Exclusive OR



```

\begin{pspicture}(-0.5,0)(3,3)
\logic[logicType=exor,%
      logicShowNode=true]{ExOR1}
\end{pspicture}

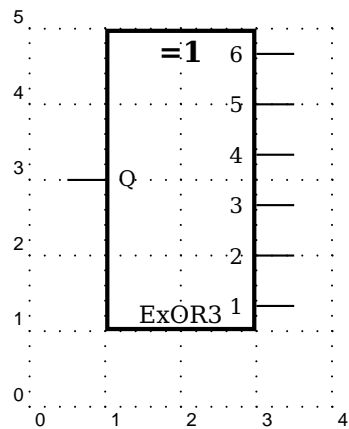
```



```

\begin{pspicture}(-0.5,0)(3,3)
\logic[logicType=exor,%
      logicChangeLR=true]{ExOR2}
\end{pspicture}

```

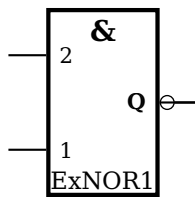


```

\begin{pspicture}(4,5)
\psgrid
\logic[logicType=exor,%
      logicShowNode=true,%
      logicNInput=6,%
      logicWidth=2,%
      logicHeight=4,%
      logicChangeLR=true](1,1){ExOR3}
\end{pspicture}

```

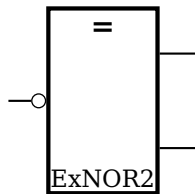
## Exclusive NOR



```

1 \begin{pspicture}(-0.5,0)(3,3)
2 \logic[logicType=exnor",%
3   logicShowNode=true]{ExNOR1}
4 \end{pspicture}

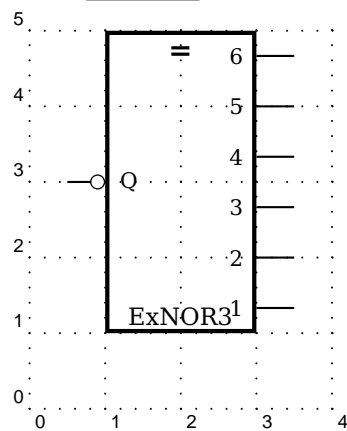
```



```

1 \begin{pspicture}(-0.5,0)(3,3)
2 \logic[logicType=exnor",%
3   logicChangeLR=true]{ExNOR2}
4 \end{pspicture}

```

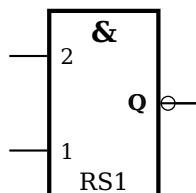


```

1 \begin{pspicture}(4,5)
2 \psgrid
3 \logic[logicType=exnor",%
4   logicShowNode=true,%
5   logicNInput=6,%
6   logicWidth=2,%
7   logicHeight=4,%
8   logicChangeLR=true](1,1){ExNOR3}
9 \end{pspicture}

```

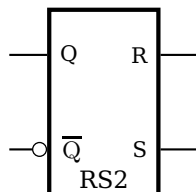
## 3.3 RS Flip Flop



```

1 \begin{pspicture}(-1,-1)(3,3)
2 \logic[logicShowNode=true,%
3   logicType=RS"]{RS1}
4 \end{pspicture}

```

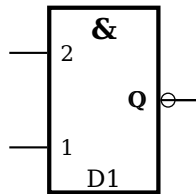


```

1 \begin{pspicture}(-1,-1)(3,3)
2 \logic[logicShowNode=true,%
3   logicType=RS,%
4   logicChangeLR=true]{RS2}
5 \end{pspicture}

```

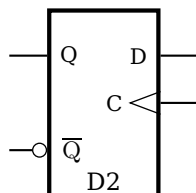
### 3.4 D Flip Flop



```

1 \begin{pspicture}(-1,-1)(3,3)
2 \logic[logicShowNode=true,%
3   logicType=D"]{D1}
4 \end{pspicture}

```

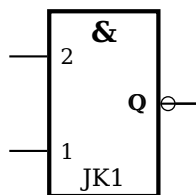


```

1 \begin{pspicture}(-1,-1)(3,3)
2 \logic[logicShowNode=true,%
3   logicType=D,%
4   logicChangeLR=true]{D2}
5 \end{pspicture}

```

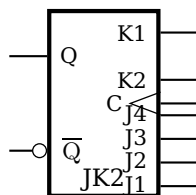
### 3.5 JK Flip Flop



```

1 \begin{pspicture}(-1,-1)(3,3)
2 \logic[logicShowNode=true,%
3   logicType=JK",%
4   logicKInput=2,%
5   logicJInput=2]{JK1}
6 \end{pspicture}

```

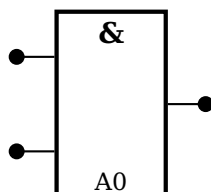


```

1 \begin{pspicture}(-1,-1)(3,3)
2 \logic[logicShowNode=true,%
3   logicType=JK,%
4   logicKInput=2, logicJInput=4,%
5   logicChangeLR=true]{JK2}
6 \end{pspicture}

```

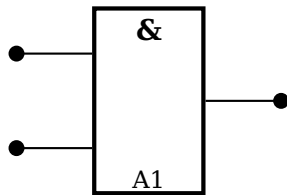
### 3.6 Other Options



```

1 \begin{pspicture}(-0.5,0)(3,2.5)
2 \logic[logicShowDot=true]{A0}
3 \end{pspicture}

```



```

1 \begin{pspicture}(-1,0)(3,2.5)
2 \logic[logicWireLength=1,%
3   logicShowDot=true]{A1}
4 \end{pspicture}

```

The unit of `logicWireLength` is the same than the actual one for `pstricks`, set by the unit option.

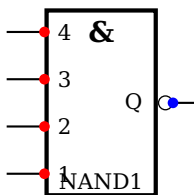
### 3.7 The Node Names

Every logic circuit is defined with its name, which should be a unique one. If we have the following NAND circuit, then `pst-circ` defines the nodes

NAND11, NAND12, NAND13, NAND14, NAND1Q

If there exists an inverted output, like for all Flip Flops, then the negated one gets the appendix `neg` to the node name. For example:

NAND1Q, NAND1Qneg



```

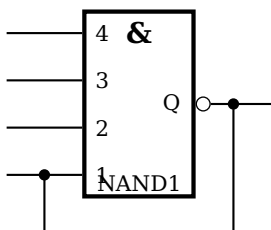
1 \begin{pspicture}(-0.5,0)(2.5,3)
2 \logic[logicShowNode=true,%
3   logicLabelstyle=\footnotesize,%
4   logicType=nand,%
5   logicNInput=4]{NAND1}
6 \multido{\n=1+1}{4}{%
7   \pscircle*[linecolor=red](NAND1\n){2pt}%
8 }
9 \pscircle*[linecolor=blue](NAND1Q){2pt}
10 \end{pspicture}

```

Now it is possible to draw a line from the output to the input

`\ncbar[angleA=0,angleB=180]{<Node A>}{<Node B>}`

It may be easier to print a grid since the drawing phase and then comment it out if all is finished.

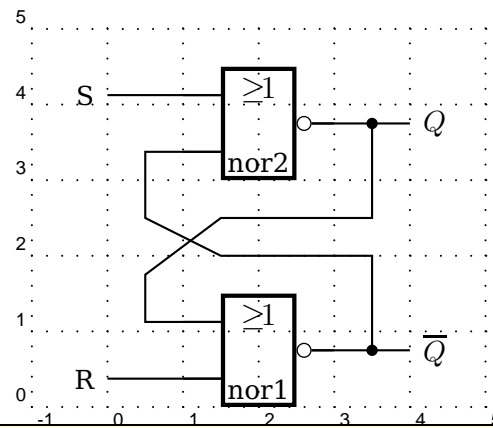


```

1 \begin{pspicture}(-1,-1)(2.5,3)
2 \logic[logicShowNode=true,%
3   logicLabelstyle=\footnotesize,%
4   logicType=nand,%
5   logicWireLength=1,%
6   logicNInput=4]{NAND1}
7 \nnode(-0.5,0|NAND11){tempA}
8 \nnode(2,0|NAND1Q){tempB}
9 \end{pspicture}
10 \ncbar[angleA=-90,angleB=0,arm=0.75,%
11   arrows=*, dotsize=0.15]{tempA}{tempB}

```

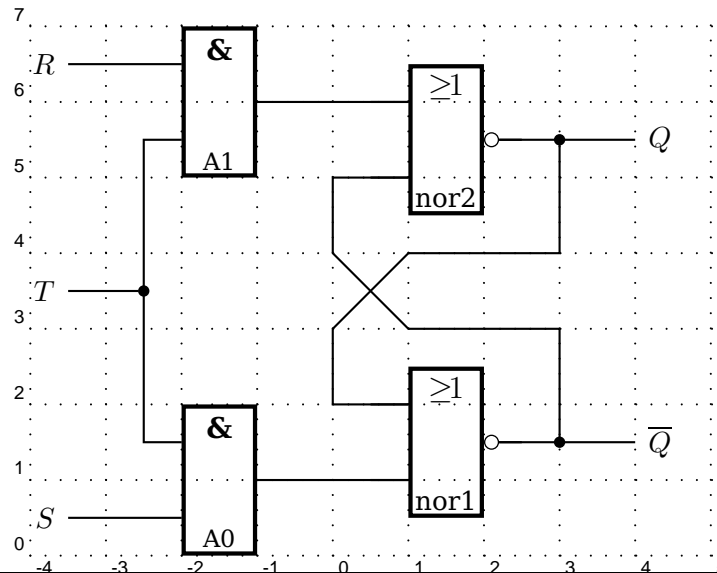
## 3.8 Examples



```

1 \begin{pspicture}(-1,0)(5,5)
2   \psgrid
3   \psset{logicType=nor, logicLabelstyle=\normalsize,%
4         logicWidth=1, logicHeight=1.5, dotsize=0.15}
5   \logic(1.5,0){nor1}
6   \logic(1.5,3){nor2}
7   \psline(nor2Q)(4,0|nor2Q)
8   \uput[0](4,0|nor2Q){$Q$}
9   \psline(nor1Q)(4,0|nor1Q)
10  \uput[0](4,0|nor1Q){$\overline{Q}$}
11  \psline{*}(3.50,0|nor2Q)(3.5,2.5)(1.5,2.5)
12    (0.5,1.75)(0.5,0|nor12)(nor12)
13  \psline{*}(3.50,0|nor1Q)(3.5,2)(1.5,2)
14    (0.5,2.5)(0.5,0|nor21)(nor21)
15  \psline(0,0|nor11)(nor11)\uput[180](0,0|nor11){R}
16  \psline(0,0|nor22)(nor22)\uput[180](0,0|nor22){S}
17 \end{pspicture}

```



```

1 \begin{pspicture}(-4,0)(5,7)
2   \psgrid
3   \psset{logicWidth=1, logicHeight=2, dotsize=0.15}
4   \logic[logicWireLength=0](-2,0){A0}
5   \logic[logicWireLength=0](-2,5){A1}
6   \ncbar[angleA=-180,angleB=-180,arm=0.5]{A11}{A02}
7   \psline[dotsize=0.15]{-}* (-3.5,3.5) (-2.5,3.5)
8   \uput[180](-3.5,3.5){T}
9   \psline(-3.5,0.5)(A01)\uput[180](-3.5,0.5){S}
10  \psline(-3.5,6.5)(A12)\uput[180](-3.5,6.5){R}
11  \psset{logicType=nor, logicLabelstyle=\normalsize}
12  \logic(1,0.5){nor1}
13  \logic(1,4.5){nor2}
14  \psline(nor2Q)(4,0|nor2Q)
15  \uput[0](4,0|nor2Q){Q}
16  \psline(nor1Q)(4,0|nor1Q)
17  \uput[0](4,0|nor1Q){\overline{Q}}
18  \psline{*-}(3,0|nor2Q)(3,4)(1,4)(0,3)(0,0|nor12)(nor12)
19  \psline{*-}(3,0|nor1Q)(3,3)(1,3)(0,4)(0,0|nor21)(nor21)
20  \psline(A0Q)(nor11)
21  \psline(A1Q)(nor22)
22 \end{pspicture}

```

## 4 Adding new components

Adding new components is not simple. As a matter of fact, because of the complex mechanism of `\multidipole`, there are multiple steps. Nevertheless, it can take some time...

If you want to modify the code, you need to know the following things. For a dipole, you first need to define the following items:

```

1 \def\component_name{\ifnextchar[{\pst@component_name}{\pst@component_name[]}}
2 %
3 \def\pst@component/_name[#1](#2)(#3)#4{%
4   \pst@draw@dipole{#1}{#2}{#3}{#4}\pst@draw@component_name
5   }\ignorespaces}
6 %

```



```

7 \def\pst@multidipole@component_name{\@ifnextchar[{\pst@multidipole@component_name@}
8   {\pst@multidipole@component_name@[]}}
9 %
10 \def\pst@multidipole@component_name[#1]#2{%
11   \expandafter\def\csname pst@circ@tmp@number\pst@circ@count@iii\endcsname{#2}%
12   {\psset{#1}%
13     \ifPst@circ@parallel\aftergroup\advance\aftergroup\pst@circ@count@i\aftergroup\
14       m@ne\fi}%
15   \pst@circ@count@ii=\pst@circ@count@i%
16   \advance\pst@circ@count@ii\@ne%
17   \toks0\expandafter{\pst@multidipole@output}%
18   \edef\pst@multidipole@output{%
19     \the\toks0%
20     \pst@multidipole@def@coord%
21     \noexpand\component_name[#1]%
22     (! X@the\pst@circ@count@i\space Y@the\pst@circ@count@i)%
23     (! X@the\pst@circ@count@ii\space Y@the\pst@circ@count@ii)%
24     {\noexpand\csname pst@circ@tmp@number\pst@circ@count@iii\endcsname}%
25   }%
26   \pst@multidipole@
27 }
28 %
29 \def\pst@draw@component_name{%
30   % The PSTricks code for your component
31   % The center of the component is at (0,0)
32   \pnode(component_left_end,0){dipole@1}
33   \pnode(component_right_end,0){dipole@2}}

```

Then, you have to make some changes in the `\multidipole` core code...In the definition of `\pst@multidipole`, look for the last `\ifx` test

```

1 % ...
2 % Extract from \pst@multidipole
3   \else
4     \ifx\circledipole #4%
5       \let\next\pst@multidipole@circledipole
6     \else
7       \ifx\LED #4%
8         \let\next\pst@multidipole@LED
9       \else
10        % Put your modification here
11        \let\next\ignorespaces
12      \fi
13    \fi
14  \fi
15 % Extract from \pst@multidipole
16 % ...

```

and add (marked with %%)

```

1 % ...
2 % Extract from \pst@multidipole
3   \else
4     \ifx\circledipole #4%
5       \let\next\pst@multidipole@circledipole
6     \else
7       \ifx\LED #4%

```

```

8           \let\next\pst@multidipole@LED
9       \else
10          \ifx\component_name #4%%
11             \let\next\pst@multidipole@component_name%%
12          \else%%
13             \let\next\ignorespaces
14          \fi%%
15        \fi
16      \fi
17    \fi
18    % Extract form \pst@multidipole
19    % ...

```

Do the same in \pst@multidipole@

```

1    % ...
2    % Extract from \pst@multidipole@
3      \else
4        \ifx\circledipole #1%
5          \let\next\pst@multidipole@circledipole
6        \else
7          \ifx\LED #1%
8            \let\next\pst@multidipole@LED
9          \else
10             \ifx\component_name #1%%
11                \let\next\pst@multidipole@component_name%%
12             \else%%
13                \let\next\ignorespaces
14             \pst@multidipole@output
15          \fi%%
16        \fi
17      \fi
18    \fi
19    % Extract form \pst@multidipole@
20    % ...

```

and that's it! All you have to do then is send your modified `pst-circ.tex` to me and it will become part of the official release of `pst-circ`.

**Important:** Pay attention to the comment character `%` at the end of lines. They are very important in order to avoid spurious blanks.

## 5 List of all optional arguments for pst-fcirc

Key	Type	Default
intensity	ordinary	true
intensitylabel	ordinary	[none]
intensitylabelcolor	ordinary	[none]
intensitylabeloffset	ordinary	[none]
intensitycolor	ordinary	[none]
intensitywidth	ordinary	[none]
tension	ordinary	true
tensionlabel	ordinary	[none]
tensionlabelcolor	ordinary	[none]
tensionoffset	ordinary	[none]
tensionlabeloffset	ordinary	[none]
tensioncolor	ordinary	[none]
tensionwidth	ordinary	[none]
labeloffset	ordinary	[none]
labelangle	ordinary	[none]
labelInside	ordinary	[none]
dipoleconvention	ordinary	[none]
directconvention	ordinary	true
dipolestyle	ordinary	[none]
parallel	ordinary	true
parallelarm	ordinary	[none]
parallelsep	ordinary	[none]
parallelnode	ordinary	true
intersect	ordinary	true
intersectA	ordinary	[none]
intersectB	ordinary	[none]
OAperfect	ordinary	true
OApower	ordinary	true
OAinvert	ordinary	true
OAIplus	ordinary	true
OAIMinus	ordinary	true
OAIout	ordinary	true
OAIpluslabel	ordinary	[none]
OAIMinuslabel	ordinary	[none]
OAIoutlabel	ordinary	[none]
transistorcircle	ordinary	true
transistorinvert	ordinary	true
transistoribase	ordinary	true
transistoricollector	ordinary	true
transistoriemitter	ordinary	true
transistoribaselabel	ordinary	[none]
transistoricollectorlabel	ordinary	[none]

*Continued on next page*

*Continued from previous page*

Key	Type	Default
transistoriemitterlabel	ordinary	[none]
FETchanneltype	ordinary	[none]
FETmemory	ordinary	true
transistortype	ordinary	[none]
basesep	ordinary	[none]
TRot	ordinary	[none]
circedge	ordinary	[none]
primarylabel	ordinary	[none]
secondarylabel	ordinary	[none]
transformeriprimary	ordinary	true
transformerisecondary	ordinary	true
transformeriprimarylabel	ordinary	[none]
transformerisecondarylabel	ordinary	[none]
tripolestyle	ordinary	[none]
variable	ordinary	true
logicChangeLR	ordinary	false
logicShowDot	ordinary	false
logicShowNode	ordinary	false
logicWidth	ordinary	[none]
logicHeight	ordinary	[none]
logicType	ordinary	[none]
logicNInput	ordinary	[none]
logicJInput	ordinary	[none]
logicKInput	ordinary	[none]
logicWireLength	ordinary	[none]
logicLabelstyle	ordinary	[none]
logicSymbolstyle	ordinary	[none]
logicSymbolpos	ordinary	[none]
logicNodestyle	ordinary	[none]
inputarrow	ordinary	false
programmable	ordinary	false
groundstyle	ordinary	[none]
antennastyle	ordinary	[none]
output	ordinary	[none]
L0style	ordinary	[none]
dipoleinput	ordinary	[none]
value	ordinary	[none]
tripoleinput	ordinary	[none]
tripoleconfig	ordinary	[none]
couplerstyle	ordinary	[none]
quadripoleinput	ordinary	[none]
connectingdot	ordinary	true

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