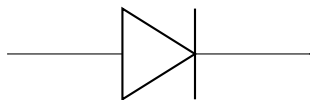
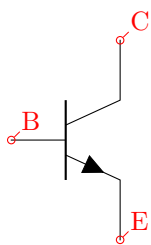


## 1 DIODO



$$\begin{cases} I_D = 0 & \text{per } V_D < V_\gamma \\ V_D = V_\gamma & \text{per } I_D > 0 \end{cases}$$

## 2 BJT



- OFF

$$I_B = I_C = I_E = 0 \quad \text{per } V_{BE} < V_\gamma$$

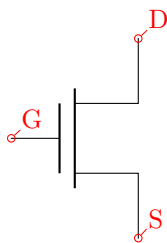
- AD

$$\begin{aligned} V_{BE} &= V_\gamma & \text{per } V_{CE} > V_{CE_{SAT}} \\ I_C &= \beta_F I_B \end{aligned}$$

- SAT

$$\begin{aligned} V_{BE} &= V_\gamma \\ V_{CE} &= V_{CE_{SAT}} & I_C < \beta_F I_B \end{aligned}$$

## 3 MOSFET N-MOS



- OFF

$$I_{DS} = 0 \quad \text{per } V_{GS} < V_{Tn}$$

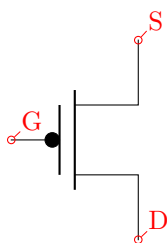
- SATURAZIONE

$$I_D = \frac{\beta}{2} (V_{GS} - V_{Tn})^2 \quad \text{per } \begin{cases} V_{DS} \geq V_{GS} - V_{Tn} \\ V_{GS} \geq V_{Tn} \end{cases}$$

- LINEARITÀ

$$I_D = \beta \left( (V_{GS} - V_T) V_{DS} - \frac{V_{DS}^2}{2} \right) \quad \text{per } \begin{cases} V_{DS} < V_{GS} - V_{Tn} \\ V_{GS} \geq V_{Tn} \end{cases}$$

## 4 P-MOS



- OFF

$$I_{SD} = 0 \quad \text{per } V_{SG} < |V_{TP}|$$

- SATURAZIONE:

$$I_{SD} = \frac{\beta}{2} (V_{SG} - |V_{TP}|)^2 \quad \text{per } V_{SD} \geq V_{SG} - |V_{TP}|$$

- LINEARITÀ:

$$I_{SD} = \beta \left( (V_{SG} - |V_{TP}|) V_{SD} - \frac{V_{SD}^2}{2} \right) \quad \text{per } \begin{cases} V_{SD} < V_{SG} - |V_{TP}| \\ V_{SG} \geq |V_{TP}| \end{cases}$$