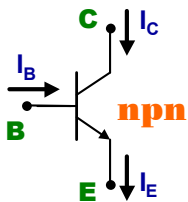
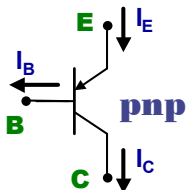


BJT

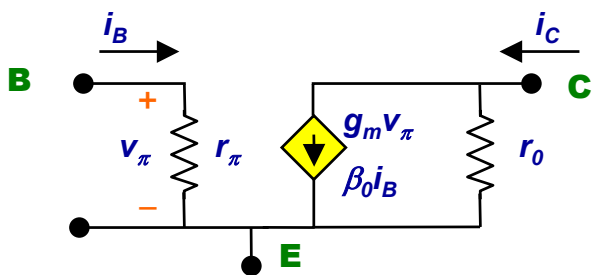


Attiva	Saturazione	Spento
$V_{BE} = 0.7 \text{ V}$	$V_{BE} = 0.7 \text{ V}$	$I_B = 0$
$I_C = \beta_F I_B$	$V_{CE} = 0.2 \text{ V}$	$I_C = 0$
$I_E = (\beta_F + 1) I_B$	$I_C < \beta_F I_B$	$I_E = 0$
$V_{CE} > 0.2 \text{ V}$		$V_{BE} < 0.7 \text{ V}$



Attiva	Saturazione	Spento
$V_{BE} = -0.7 \text{ V}$	$V_{BE} = -0.7 \text{ V}$	$I_B = 0$
$I_C = \beta_F I_B$	$V_{CE} = -0.2 \text{ V}$	$I_C = 0$
$I_E = (\beta_F + 1) I_B$	$I_C < \beta_F I_B$	$I_E = 0$
$V_{CE} < -0.2 \text{ V}$		$V_{BE} > -0.7 \text{ V}$

Piccolo segnale



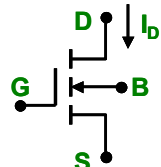
$$r_\pi = \frac{\beta_0}{g_m}$$

$$g_m = \frac{I_C}{V_T}$$

$$r_o = \frac{|V_A| + |V_{CE}|}{I_C}$$

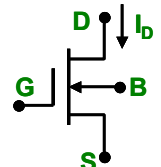
MOSFET

E-nMOSFET



$$V_t > 0$$

D-nMOSFET



$$V_t < 0$$

Lineare

$$V_{GS} > V_t \text{ e}$$

$$V_{DS} < V_{GS} - V_t$$

(o $V_{GD} > V_t$)

Saturazione

$$V_{GS} > V_t \text{ e}$$

$$V_{DS} > V_{GS} - V_t$$

(o $V_{GD} < V_t$)

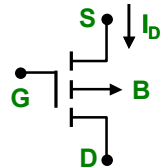
Spento

$$V_{GS} < V_t$$

$$I_D = 0$$

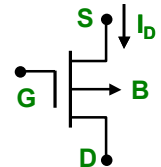
$$V_{GS} > 0, V_{DS} > 0, \lambda > 0$$

E-pMOSFET



$$V_t < 0$$

D-pMOSFET



$$V_t > 0$$

Lineare

$$V_{GS} < V_t \text{ e}$$

$$V_{DS} > V_{GS} - V_t$$

(o $V_{GD} < V_t$)

Saturazione

$$V_{GS} < V_t \text{ e}$$

$$V_{DS} < V_{GS} - V_t$$

(o $V_{GD} > V_t$)

Spento

$$V_{GS} > V_t$$

$$I_D = 0$$

$$V_{GS} < 0, V_{DS} < 0, \lambda < 0$$

Lineare

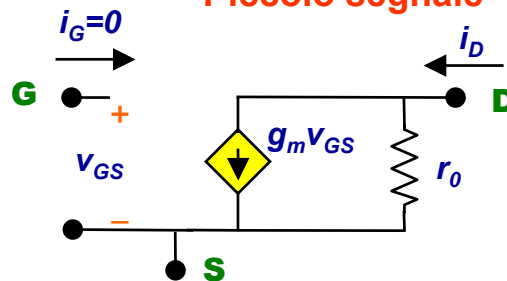
$$I_{DSS} = \frac{1}{2} k'_{n,p} \left(\frac{W}{L} \right) V_t^2$$

$$I_D = k'_{n,p} \left(\frac{W}{L} \right) \left[(V_{GS} - V_t) V_{DS} - \frac{1}{2} V_{DS}^2 \right]$$

Saturazione

$$I_D = I_{DSS} \left(1 - \frac{V_{GS}}{V_t} \right)^2 (1 + \lambda V_{DS})$$

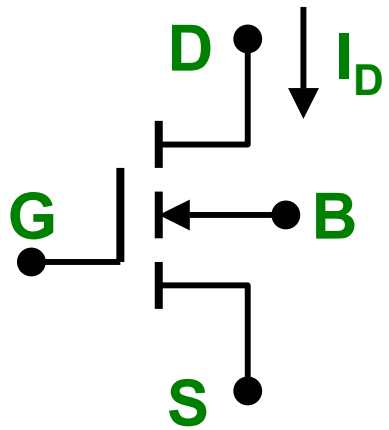
Piccolo segnale



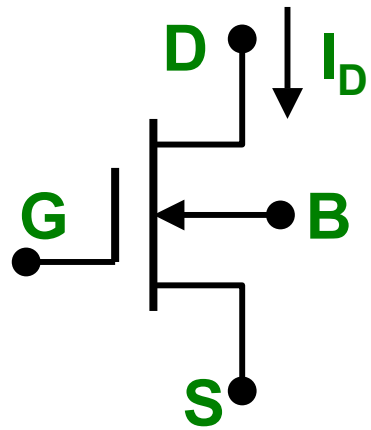
$$g_m = \frac{2}{|V_t|} \sqrt{I_{DSS} I_D (1 + \lambda V_{DS})}$$

$$r_o = \frac{1}{|\lambda| + |V_{DS}|} \cong \frac{1}{|\lambda| I_D}$$

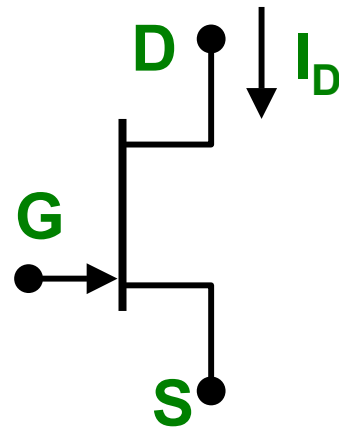
E-nMOSFET



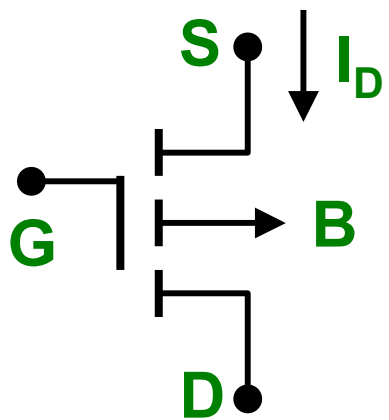
D-nMOSFET



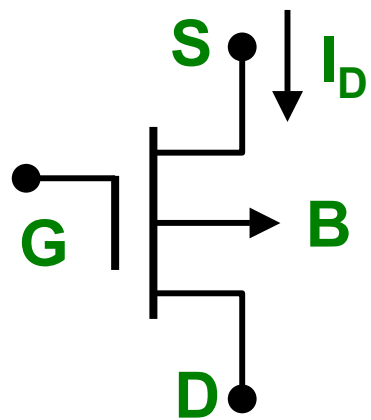
n - JFET



E-pMOSFET



D-pMOSFET



p - JFET

