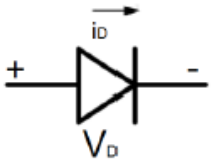
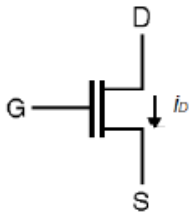
Cheatsheet

Diode: constant voltage drop model



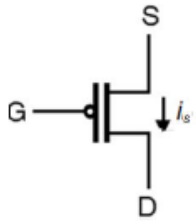
If $V_D < 0.7$ V, $i_D = 0$
If $i_D > 0$, $V_D = 0.7$ V

NMOS model



Region	Conditions	Model
Cut off	$V_{GS} < V_{TN}$	$i_D = 0$
Triode	$V_{GS} > V_{TN}$; $V_{DS} < V_{GS} - V_{TN}$	$i_D = K\cdot(V_{GS}-V_{TN})\cdot V_{DS}$ or $R_{ON\_N} = 1/(K\cdot(V_{GS}-V_{TN}))$
Saturation	$V_{GS} > V_{TN}$; $V_{DS} > V_{GS} - V_{TN}$	$i_D = K/2 \cdot (V_{GS}-V_{TN})^2$

PMOS model



Region	Conditions	Model
Cut off	$V_{SG} < \lvert V_{TP}\rvert$	$i_s = 0$
Triode	$V_{SG} > \lvert V_{TP}\rvert$; $V_{SD} < V_{SG} - \lvert V_{TP}\rvert$	$i_s = K\cdot(V_{SG} - \lvert V_{TP}\rvert)\cdot V_{SD}$ or $R_{ON\_P} = 1/(K\cdot(V_{SG} - \lvert V_{TP}\rvert))$
Saturation	$V_{SG} > \lvert V_{TP}\rvert$; $V_{SD} > V_{SG} - \lvert V_{TP}\rvert$	$i_s = K/2\cdot(V_{SG} - \lvert V_{TP}\rvert)^2$

For first-order differential equation $\frac{dv}{dt} + A \cdot v = B$, the general solution is $v(t) = \frac{B}{A} + k \cdot e^{-A\cdot t}$