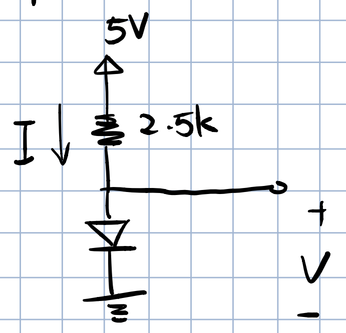
example.

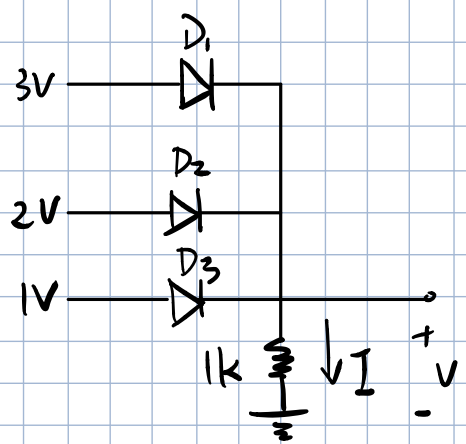


1) Ideal diode model ($V_D = 0$ when conducting)

diode on: $V = 0V$, $I = \frac{5-0}{2.5k} = 2mA$

2) Diode CVD model ($V_D = 0.7V$ when conducting)

diode on: $V = 0.7V$, $I = \frac{5-0.7}{2.5k} = 1.72mA$



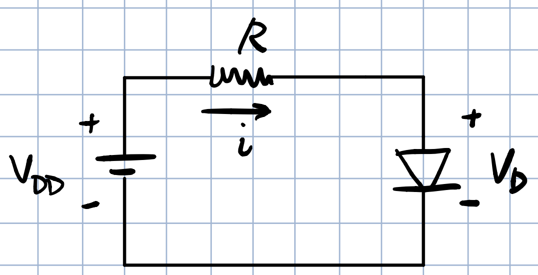
1) ideal diode. (D_1 on, 2 & 3 off)

$V = 3V$ $I = 3/1k = 3mA$

2) CVD model (D_1 on, 2 & 3 off)

$V = 3V$ $I = 3-0.7/1k = 2.3 mA$

Diode Exponential Model.

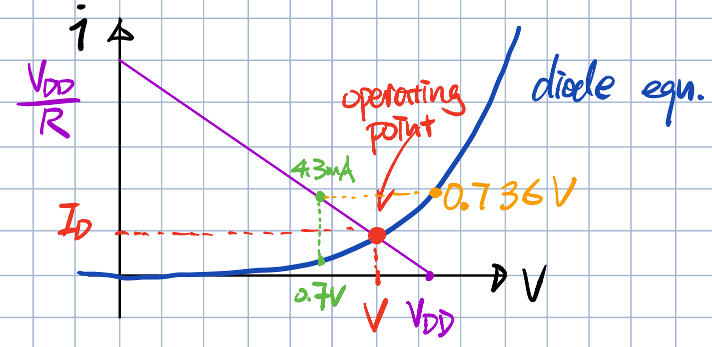


diode equ.: $i = I_S e^{V_D/V_T}$ ← 25mV

cct equ.: (KVL)

$-V_{DD} + Ri + V_D = 0$, $i = \frac{V_{DD} - V_D}{R}$

load line



Solve by iteration starting w/ some given value.

i.e. $V_{DD} = 5V$ $R = 1k\Omega$, diode has $0.7V$ at $1mA$

1st iteration: $V_D = 0.7V$

load eqn. $I_D = \dfrac{V_{DD} - V_D}{R} = \dfrac{5-0.7}{1k} = \underline{\underline{4.3mA}}$ new I_D

diode eqn. $V_2 - V_1 = V_T \ln \dfrac{I_2}{I_1}$

$V_2 = V_1 + V_T \ln \dfrac{I_2}{I_1} = 0.7 + (25mV) \ln \dfrac{4.3mA}{1mA}$

$= \underline{\underline{0.736\,V}}$ new V_D

2nd iteration: $V_D = 0.736V$

load eqn. $I_D = \dfrac{V_{DD} - V_D}{R} = \dfrac{5-0.736}{1k} = \underline{\underline{4.264mA}}$ new I_D

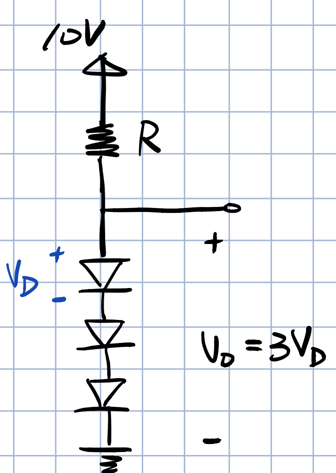
diode eqn. $V_2 = V_1 + V_T \ln \dfrac{I_2}{I_1} = 0.736 + (25mV) \ln \dfrac{4.264}{4.3}$

$= \underline{\underline{0.736\,V}}$ new V_D

not much change in value V_D or I_D, we stop iteration.

$\Rightarrow$ Operation pt. is $(I_D, V_D) = (4.264mA, 0.736V)$

example. Design the cct to have a open cct voltage of 2.4V assume tht the diode are 0.7V @ 1mA



we want each diode to have 0.8V

$\rightarrow$ find the current required. (i)

$\rightarrow$ calculate the resistance (R)

diode eqn. $i = I_s e^{V_D/V_T}$

$V_2 - V_1 = V_T \ln \dfrac{I_2}{I_1}$

$0.8 - 0.7 = (25mV) \ln \dfrac{I_2}{\ }$

1mA

$\Rightarrow I_2 = 54.6\,mA$

load eqn. : $R = \frac{10 - V_o}{i} = \frac{10 - 2.4}{54.6\,mA}$

$R = 139\,\Omega$

Small Signal diode model.