電子學(一) 第一次期中考 Chapter 1 & 2

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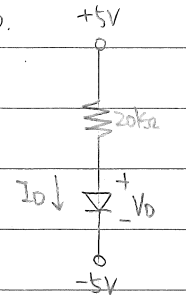
1. (a) P型半導體 (b) 導電度和能隙的關係

2. $T = 300°k$ $p = 10^6 e^{-x/L_p}$ where $L_p = 10^{-3}cm$ $D_p = 10cm^2/s$

(a) $x=0$ $J_p = -eD_p\frac{dp}{dx} = -1.6\times10^{-19}\times10\times10^6 e^0\times\frac{-1}{10^{-3}} = 1.6\times10^{-9}\ A/cm^2$

(b) $x=10^{-3}$ $J_p = -eD_p\frac{dp}{dx} = -1.6\times10^{-19}\times10\times10^6 e^1\times\frac{-1}{10^{-3}} = 4.35\times10^{-9}\ A/cm^2$ #

3.



$I_S = 10^{-13}A$ $V_T = 0.7V$

(a) piecewise linear model

$I_D = (10-0.6)/20k = 0.47mA$

$V_D = (10 - 20k\times0.47m) = 0.6V$

(b) $I_D = \frac{10-V_D}{20k}$, $I_D = I_S(e^{\frac{V_D}{V_T}}-1)$

$V_D = V_T\ln(\frac{I_D}{I_S}-1)$

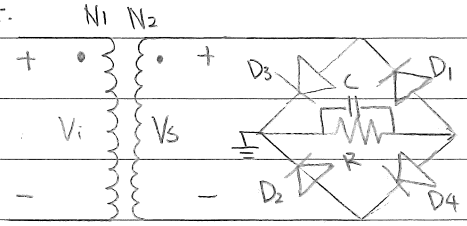
$V_D = 0.5V \Rightarrow I_D = 0.475mA \Rightarrow V_D = 0.5493V$

$V_D = 0.5493V \Rightarrow I_D = 0.471mA \Rightarrow V_D = 0.5497V$

$V_D = 0.549V$

$I_D = 0.471mA$ #

4.



$V_T = 0.7V$ $F = 60Hz$ $R_L = 125\Omega$

$V_{op} = 15V$ $V_r = 0.3V$

(a) $15 = V_S - 0.7\times2 \Rightarrow V_S = 16.4V$

$V_S(t) = 16.4\sin377t$

(b) $0.3 = \frac{15}{2\times60\times125\times C} \Rightarrow C = \frac{15}{2\times60\times125\times0.3} = 3.33mF$

(c) $PIV = 0.7+15 = 15.7V$ #

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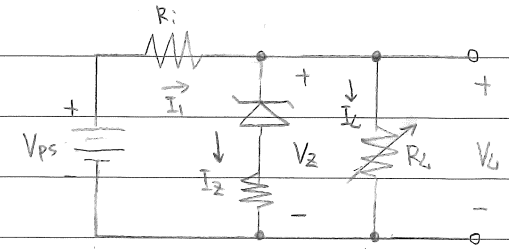
5.



$V_{PS} = 20V \pm 25\%$ (15~25)

$I_L = 0 \sim 20mA$

(a) $V_Z = 10V$ $I_{Zmin} = 5mA$

$R_i = \frac{15-10}{5m+20m} = \frac{5}{25m} = 0.2k\Omega$

(b)

$10 = V_{Zi} + 5 \times 125m$

$V_{Zi} = 9.875V$

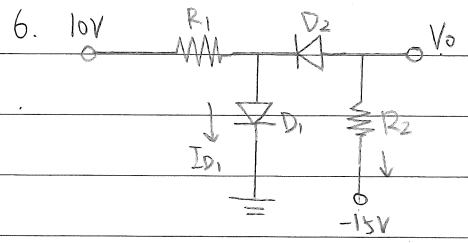
$V_{PS} = 15V$ $I_Z = \frac{15-9.875}{240+5} = 20.9mA$ $V_Z = 9.875 + 5 \times 20.9m = 9.98V$

$V_{PS} = 25V$ $I_Z = \frac{25-9.875}{240+5} = 61.4mA$ $V_Z = 9.875 + 61.4m \times 5 = 10.183V$

$10.183 - 9.98 = 0.203V$

(c) percent source $= \frac{10-10.163}{24-16} \times 100\% = \frac{0.163}{8} \times 100\% = 2.03\%$ #

6.



(a) $R_1 = 10k\Omega$ $R_2 = 5k\Omega$

設 D_1 on D_2 on

$I_{R1} = \frac{10-0.7}{10k} = 0.93mA$

$I_{R2} = \frac{1.4-(-15)}{5k} = 3.28mA$

$V_{D2} = -15 + 3.28m \times 5k - 0.7 = -2.1$ (不合)

(b) $R_1 = 5k\Omega$ $R_2 = 10k\Omega$

設 D_1 on D_2 on

$I_{R1} = 1.86mA$ $I_{R2} = 1.64mA$

$I_{D2} = -(1.86m - 1.64m) = -1.22mA$ (不合)

設 D_1 on D_2 off

$I_{R1} = 1.86mA$ $I_{R2} = 0mA$

$V_o = -15V$ #

D_1 on D_2 off

$I_{R1} = 0.93mA$ $V_{D2} = -15 - 0.7 < 0$ (合)

$V_o = -15V$

7. 很簡單