

Design & Simulate 5 Ex1.8
ECE2204 CRN:82929

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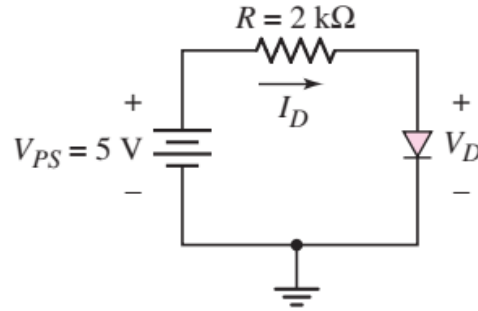
Problem 5.8.a.1:

Design

Determine the diode voltage and current for the circuit at $T = 300K$ with $V_T = 0.026V$ and $R = 0.1\Omega$. Consider the DFLS220L diode with the following datasheet.

<https://www.diodes.com/assets/Datasheets/ds30517.pdf>

$V_R = 20V$, $I_S = 190nA$, $I_D = 0.1A$, $V_D = 0.21V$



$$I_D = I_S(e^{\frac{V_D}{V_T}} - 1) = \frac{V_{PS}}{R} - \frac{V_D}{R} \quad (1)$$

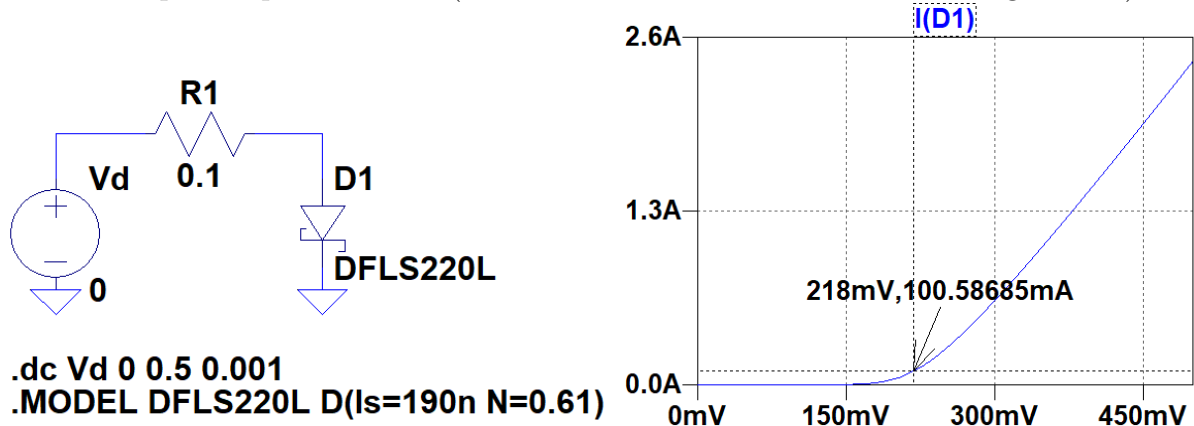
$$V_{PS} = I_S R(e^{\frac{V_D}{V_T}} - 1) + V_D \quad (2)$$

$$0.1A = (190nA)(e^{\frac{0.21V}{n \times 0.026V}} - 1) \implies n = \frac{0.21V}{\ln(\frac{0.1A}{190nA} + 1)(0.026V)} = 0.61 \quad (3)$$

The diode voltage is $V_D = 0.21$ and the diode current is $I_D = 0.1A$.

Validation

LTSpice Implementation (accurate with $< 5\%$ deviation from design result)



$Err = \frac{|210 - 218|}{210} = 0.038 = 3.8\%$ The deviation is due to inaccuracies reading the charts on the datasheet.

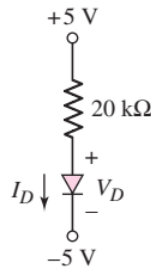
Problem 4.6.b.1:

Derived from 1.39 by changing values.

Design

Consider the following diode circuit with the following alternative values.

$D = DFLS220L$, $R = 15k\Omega$, $\pm V = 3V$, $V_T = 0.026V$

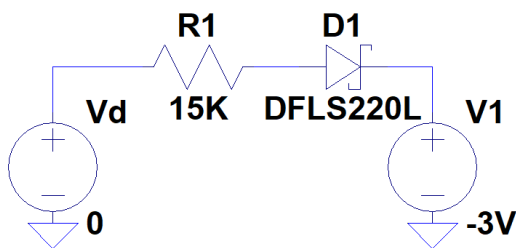


The diode reverse saturation current is $I_S = 200nA$. Determine the diode current I_D and diode voltage V_D . $I_D = 10mA$, $V_D = 0.15V$

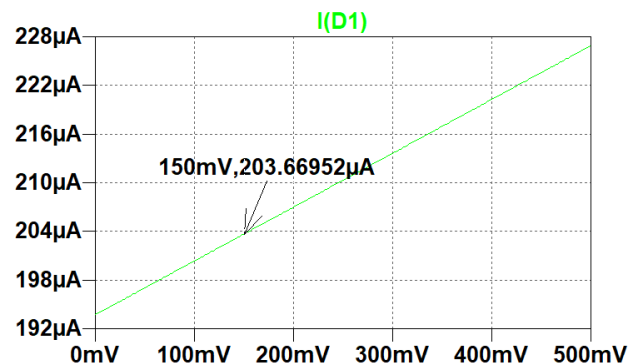
$$10mA = (200nA)(e^{\frac{V_D}{n \times 0.026V}} - 1) \implies \frac{0.15V}{\ln(\frac{10mA}{200nA} + 1)(0.026V)} = 0.53 \quad (4)$$

Validation

LTSpice Implementation (accurate with $< 1\%$ deviation from design result)



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.dc Vd 0 0.5 0.001
.MODEL DFLS220L D(Is=200n N=0.53)
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$Err = \frac{|200 - 203.6|}{200} = 0.018 = 1.8\%$ The deviation is due to inaccuracies reading the charts on the datasheet.

This assignment demonstrates capability to analyse data sheets and perform basic analysis of diode circuits.

I have neither given nor received unauthorized assistance on this assignment.