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Lab 3 Understanding Diodes

Objective:
- verify diode signal circuits and to see the relationship between current voltage and switching frequency limitations
- Matlab plots of zener diodes and P-N junction diodes & with additions of an LED
- analyze AC resistances of diodes
- different models
- Oscilloscope set-up for V-I characteristics

Equipment

- Oscilloscope
- Power supply
- DMM bench-top
- DMM, handheld
- Function Generator
- ~~Ana~~ Analog Discovery

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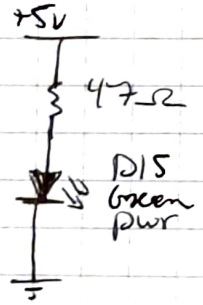
Components
- Resistors -
- 1K Ω
- 330 Ω
- 470 Ω
- 1M Ω
- Diodes -
- 1N914
- 1N3064
- 5V Zener (1N4733A or =)
- Red LED
- Green LED

Pre-Lab
- use MATLAB for calculations



D)
a) make the circuit w/ LED in backwards

b) Does it light? No, it does not

c) (Install it correctly) Does it light?
Yes, it does

d) The LED did not work in the reverse orientation because diodes have polarity. they only allow current through ~~the~~ in a certain direction

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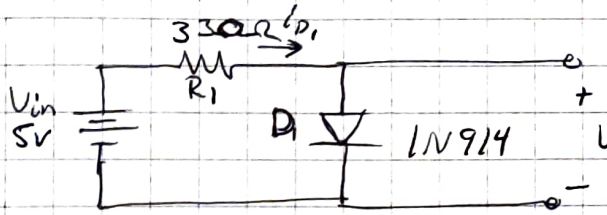
2)



D_1 - forward V = 1V
- forward I = 300 mA

a) build the circuit

b) Calculate I_{D1}, V_{R1}, V_{out} when $V_{in} = 5V$

$I_{D1} = \frac{5V}{330} = 15.1515\ mA$

$V_{R1} = 5V$

$V_0 = 4.3V$ $\quad V_0 = V_{R1} - 0.7V$

- when $V_{in} = 10V$

$I_{D1} = \frac{10V}{330\Omega} = \cancel{303.03\ mA}\ 30.303\ mA$

$V_{R1} = 10V$

$V_0 = 7.3V$

- When $V_{in} = 12V$

$I_{D1} = \frac{12V}{330\Omega} = 36.363\ mA$

$V_{R1} = 12V$

$V_0 = 11.3V$

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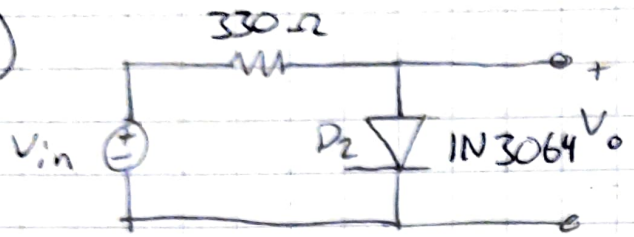
b)



- when $V_{in} = 5V$

$i_{D_2} = \frac{5V}{330} = 15.151\ mA$

$V_{R_1} = 5V$

$V_o = 5 - 0.7 = 4.3V$

- when $V_{in} = 10V$

$i_{D2} = \frac{10V}{330\Omega} = 30.303\ mA$

$V_{R_1} = 10V$

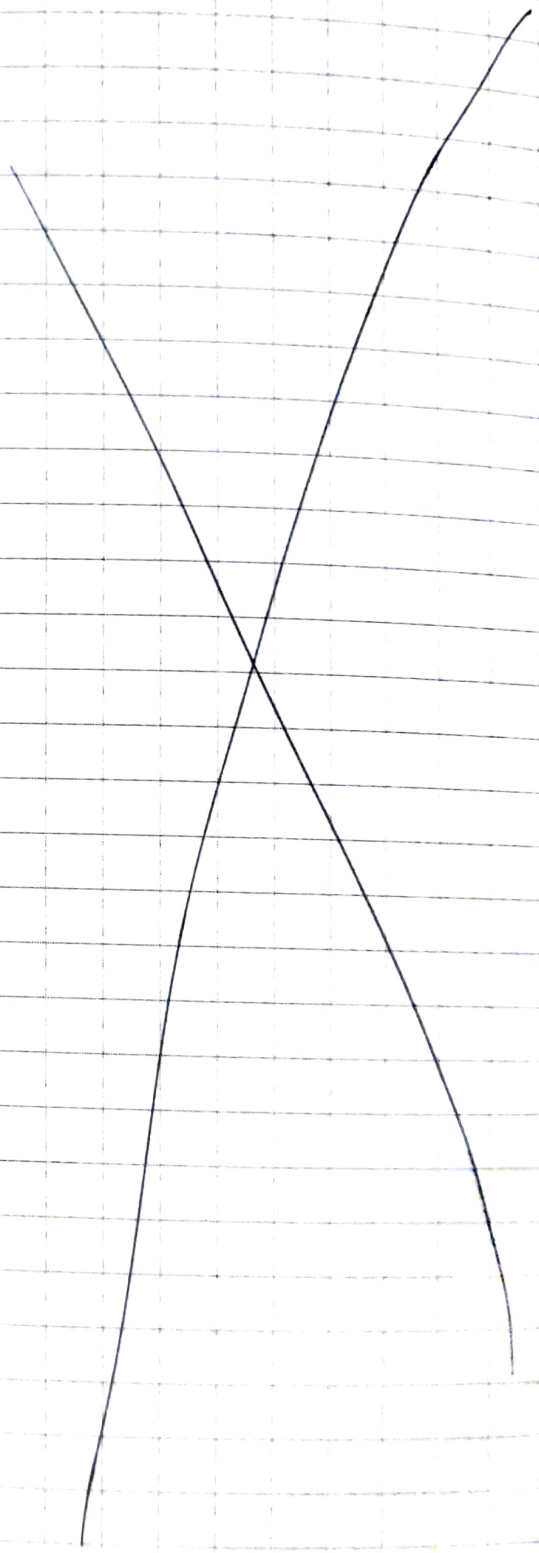
$V_o = 10 - 0.7 = 9.3V$

- when $V_{in} = 12V$

$V_{R_1} = 12V$

$i_{D_2} = \frac{12V}{330} = 36.363\ mA$

$V_o = 12 - 0.7 = 11.3V$



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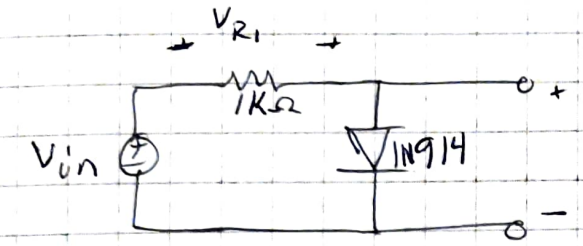
i..



V_{in} = 1KHz sinewave @ 5 V_{p-p}

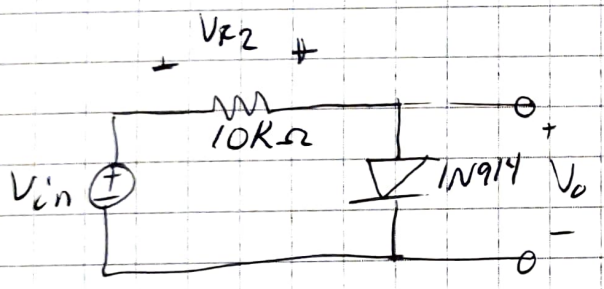
$i_{D_1} = \frac{V_{R1}}{1K} = \frac{4.3V}{1K} = 4.3mA$

$V_{R1} = V_{in} - 0.7 = 4.3\ V$

measured values

$i_{D_1} = \frac{4.3212}{1K} = 4.3212mA$

$V_{R_1} = 4.3212\ V$



V_{in} = 1K Hz sinewave @ 5 V_{p-p}

	calculated	measured
i_{D2}	0.43mA	4.4388 V
V_{R2}	4.3 V	0.44388mA

- higher voltage due to larger resistor

$i_{D2} = \frac{V_{R2}}{10K} = \frac{4.4388V}{10K}$

$i_{D2} = \frac{V_{R2}}{10K\Omega} = \frac{4.3}{10K\Omega} = 0.43mA$

$V_{R2} = V_{in} - 0.7 = 4.3\ V$

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PROPRIETARY INFORMATION

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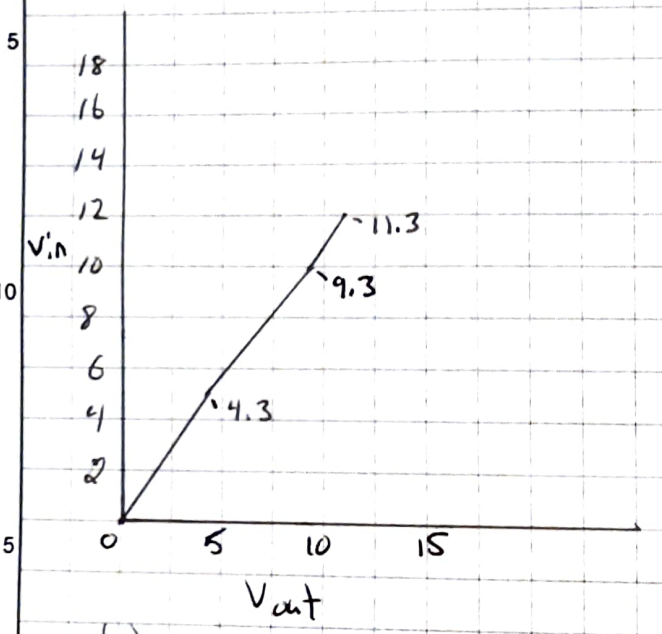
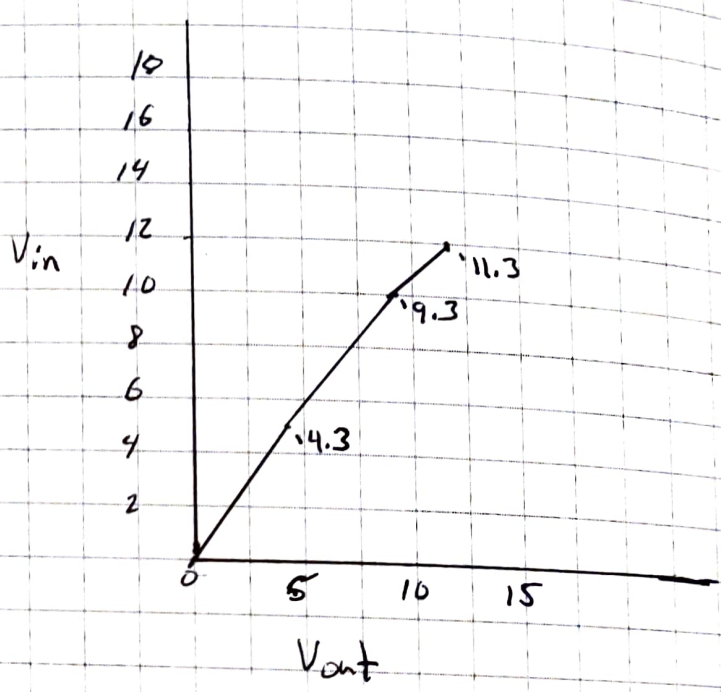
c) D_1 Voltage plot

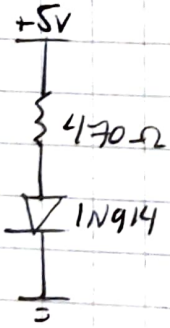


D_2 Voltage plot

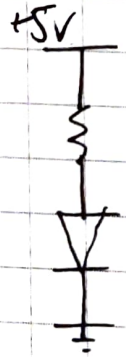


d)

D_1 IN914



D_2 IN3064



measured	datasheet value
0.7445V	1V max*

V_{D1}

measured	Datasheet value
0.74120V	5 V max*

V_{D2}

*datasheet value is forward voltage and only the max value was given.

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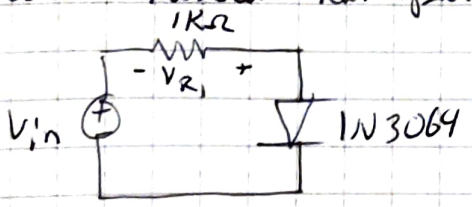
di.. missed that part.



Calc $I_{D2} = \frac{V_{R_1}}{10K\Omega}$

$= \frac{4.3}{10K}$

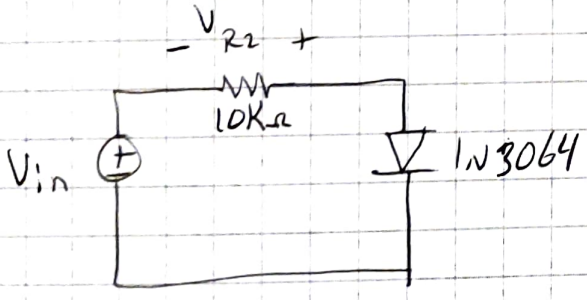
V_{in} = 1KHz sine @ $5V_{p-p}$

	calculated	measured
V_{R1}	4.3V	4.3323V
I_{D2}	4.3mA	4.332mA

$\frac{4.3323}{1K}$ $\frac{V_{in}}{1K\Omega}$

5sin(
1KΩ

forgot & scratched that.



V_{in} = 1KHz sine @ $5V_{p-p}$

	Calculated	measured
V_{R2}	4.3V	4.4424V
I_{D2}	0.43mA	0.442mA

$\frac{4.4424V}{10K\Omega}$

Calc $I_{D2} = \frac{V_{R2}}{10K\Omega}$

$= \frac{4.3V}{10K}$

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