**Datasheet for Lab 8: Diodes and Transistors**

Name(s): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Lab Kit: \_\_\_\_\_\_\_\_\_ Time to complete (to 0.1 hours):\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**PRELAB** - Watch the video: *Lab 8 – Overview*, which you can find in the [Lab 8 Video Playlist](https://www.youtube.com/playlist?list=PLhNcB8XKcGiLr6xpsy2eQhMLrjGVKi3W1)

**Part 1. The Diode**

Watch the video:*Lab 8 – Part 1*

1. Based on the i-v curve of a diode (see lab handout), explain why a diode will be damaged if a voltage of 5V is placed across it.
2. Work out a formula to calculate the diode current given: a) the diode voltage Vd, b) the resistor value R, and c) the 5 volt drop across the series combination.
3. Complete the requested measurements and calculations in the table below

|  |  |
| --- | --- |
| Voltage at LM7805 output (should be close to 5V) \_\_\_\_\_\_ | http://www.learningaboutelectronics.com/images/Voltage-regulator-pinout.png |

**Table 1. Diode Measurements and Calculations**

|  |  |  |  |
| --- | --- | --- | --- |
| Nominal R | Actual R Measured  (Ohmmeter) | Vdiode Measured | Idiode Calculated |
| 1 M |  |  |  |
| 100 K |  |  |  |
| 10 K |  |  |  |
| 1 K |  |  |  |

1. Reverse the diode in your circuit and complete the table below. Use the same formula in step 2 to calculate current. However, since the diode has been flipped, we will need to put a minus sign on both the measured voltage and calculated current for our plot to work out.

**Table 2. Diode Reverse Bias Measurement   
(Diode backwards, blocking current flow)**

|  |  |  |  |
| --- | --- | --- | --- |
| Nominal R | Actual R Measured  (Ohmmeter) | Vdiode Measured  (negative of Voltmeter reading) | Idiode, Calculated using positive Voltmeter value but entered as  negative due to reference direction for Id |
| 1 k |  |  |  |

1. Include your plot here (see instructions in step 5 of lab 8).
2. Complete the table below.

**Table 3. Diode Reverse Bias Measurement for a Red LED**

|  |  |  |  |
| --- | --- | --- | --- |
| Reverse Bias (Diode backwards, blocking current flow) | | | |
| Nominal R | Actual R Measured  (Ohmmeter) | Vdiode Measured | Idiode Calculated |
| 1 k |  | — | — |
| Forward Bias (Diode forwards, allowing current flow) | | | |
| Nominal R | Actual R Measured  (Ohmmeter) | Vdiode Measured | Idiode Calculated |
| 1 M |  |  |  |
| 100 K |  |  |  |
| 10 K |  |  |  |
| 1 K |  |  |  |

1. Include your plot here (see instructions in step 7 of lab 8).

**Part 2. The Transistor**

Watch the video:*Lab 8 – Part 2.* You may also find the *Lab 8 – In the Lab video* helpful.

1. Build the transistor circuit.
2. Complete the table below and estimate Beta for the transistor.

Use similar formulas for your calculation of diode current.

**Table 4. Common Emitter Voltage and Current Measurements**

|  |  |  |  |
| --- | --- | --- | --- |
| VBE Measured | VAnode Measured | IBase Calculated | ICollector Calculated |
|  |  |  |  |

Estimate of Beta for the transistor:

1. How does this demonstrate the transistor’s ability to control a relatively large current with a relatively small current?

**Part 3. Application** – Dusk-to-Dawn Circuit

Watch the Part 3 Overview and simulation of this circuit [here](https://www.youtube.com/watch?v=w_D9TjCCbMg&feature=youtu.be&t=604). You may also find the *Lab 8 – In the Lab video* helpful.

**Table 5. Photoresistor resistance values measured under bright light and darkness (cover with finger)**

|  |  |  |
| --- | --- | --- |
| Light level | Measured Resistance of Photo Resistor 1 | Measured Resistance of Photo Resistor 2 |
| Darkness  (cover photoresistor surface with finger) |  |  |
| Bright light  (shine flashlight at it) |  |  |

**Table 7. Use the voltage divider formula to estimate the value of Vb under darkness and bright light, then measure Vb in your actual circuit and record**

|  |  |  |
| --- | --- | --- |
| Photo Resistor Illumination | Estimated Vbase , V | Measured Vbase, V |
| Darkness |  |  |
| Bright light |  |  |

Make a video of your working dusk-to-dawn circuit and copy here:

When you are finished, please estimate the time it took to complete this lab to within 0.1 hours and enter this at the top of the datasheet.