Notebooks:

YOUR MOST POWERFUL DEBUGGING TOOL

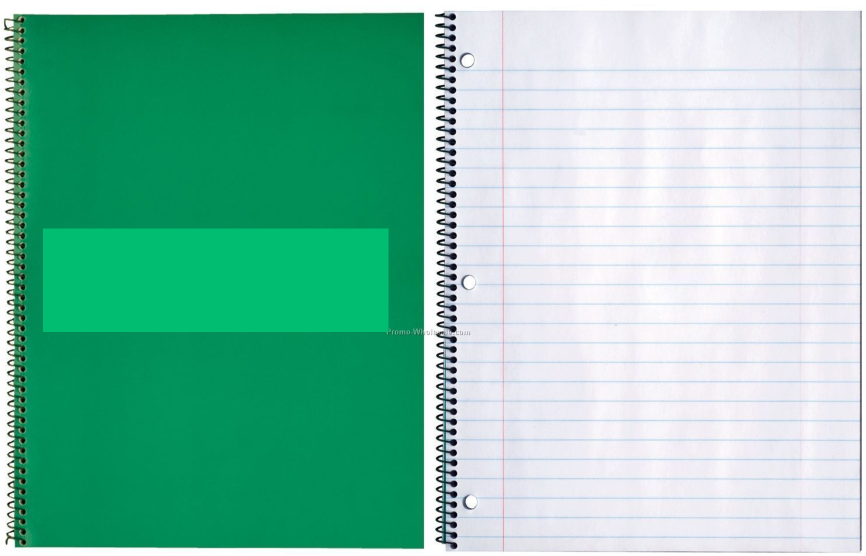
YOUR LEGAL PROTECTION

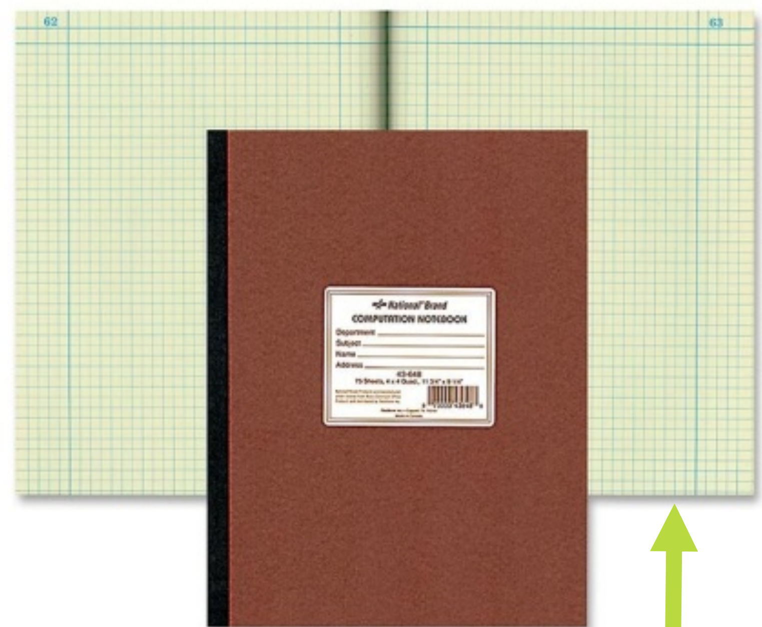
YOUR INTELLECTUAL PROPERTY PROTECTION

AN INDUSTRY STANDARD

What Is an Acceptable Notebook?

- Sewn and Numbered Pages
- Carbonless copy is not acceptable
- NOT a spiral bound notebook (pages not sewn)
- NOT a composition book (pages not numbered)





Good!

Bad!

What More is an Acceptable Notebook?

- The very best reference when writing the final report
- A record of all of your ideas and your test results
- A record of pertinent portions of datasheets
- A timeline of your project
- A way for your TA to ensure you are on schedule
- A chronicle of your design process, from brainstorming to final implementation.

How Does One Maintain a Notebook?

- Entries are to be written in PEN – preferably with blue or black ink
- **NO PENCIL.**
- Inserts (code snippets, simulation results, etc.) are to be glued in, signed in, and dated in
- Each member of the group maintains an individual notebook of individual work – Extensive copying is prohibited
- The notebook should be written legibly
- **The notebook is to be brought to every single TA meeting without exception. We need to see steady and strong progress week to week!**

What is Written in the Notebook?

- **Everything.**
- The notebook is to be a chronological catalogue of the design process
- Everything, from brainstorming to final testing results, is to be recorded
- This includes all sketches, all proposed designs and their test results, including those that fail, and all calculations
- It is okay to be wrong! The notebook will help you debug!

What is on Each Page of the Notebook?

- Your name
- The date of your work
- Your signature at the end of each entry
- Mistakes should be crossed out

The new R_1 value can be calculated as follows:

$$I_B = \frac{I_{C\text{-desired}}}{\beta} = \frac{40\ mA}{65} = 0.616\ mA$$

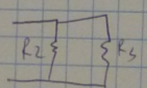
$$R_1 = \frac{V_{FG} - 0.75}{I_B} = 3.65\ k\Omega$$

With this R_1, the current through the LED's was measured as 60 mA. This implies that β is really:

$$\beta = \frac{I_C}{I_B} = \frac{60\ mA}{\left(\frac{3-0.75}{3.65}\right)} = 97.3$$

Therefore, R_1 needs to be:

$$R_1 = \frac{(3-0.75)}{\frac{40\times10^{-3}}{100}} = 5.625\ k\Omega$$



$$R_{eq} = \frac{R_2R_3}{R_2+R_3} = 5.625$$

$$R_2R_3 = 5.625R_2 + 5.625R_3$$

$$R_2 = 6$$

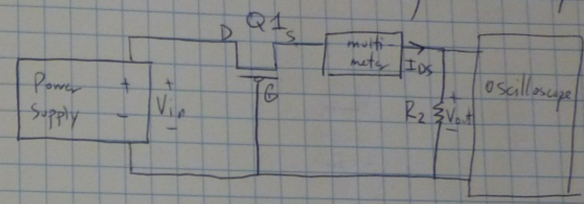
$$R_3 = \frac{5.625(6)}{6-5.625} = 90$$

With $R_1 = 5.55\ k\Omega$, $I_C = 46\ mA$, $V_{LED} = 3.4\ V$. These are the results we want to see, since these are optimal operating conditions for the LED's. The following table presents the stated results in tabular form.

R_1 (kΩ)	I_C (mA)	V_{LED} (V)
1.7	86	3.5
3.65	60	3.4
5.55	46	3.4

Conclusion: The β value for the BJT given in the datasheet is not correct for the desired operating conditions. The actual β value is 100 (with 3% tolerance). The reason I had to adjust R_1 more than once is because β is actually a function of I_C (probably a piecewise nearly constant function - e.g. β is fixed for different ranges of I_C). The design needs to be updated to reflect that $R_1 = 5.625\ k\Omega$.

Reverse Polarity Protection circuit experimental setup:



- Since the Mosfet in our actual design is surface mount, I will be testing the circuit with a different PFET (IRF 5210). The relevant device parameters are given below:

$$R_{DS\text{-}on} = 0.06\ \Omega$$
$$V_{th} = -2 \text{ to } -4\ V$$

- the power supply will deliver a variable voltage (controlled by me)
- the multimeter will measure current through the MOSFET
- the oscilloscope will measure voltage at the output.
- $R_2 =$ ~~360 Ω~~ 120 Ω

Selection of Mosfet for reverse polarity protection

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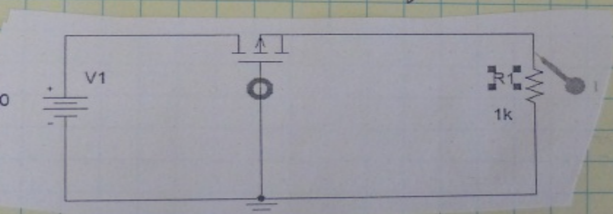
From analysis in the design on PG. 7, we know that PFET must have the following properties

$V_{th} > -3.5$ V
$I_{on,max} > 50$ mA
$R_{ds,on}$ must be as small as possible (preferably 0, but realistically in the 0.01 Ohm range)
Must be able to block $V_{DS} = -4.5$ V, at least
Must be able to handle $V_{GS} = \pm 3.5$ V

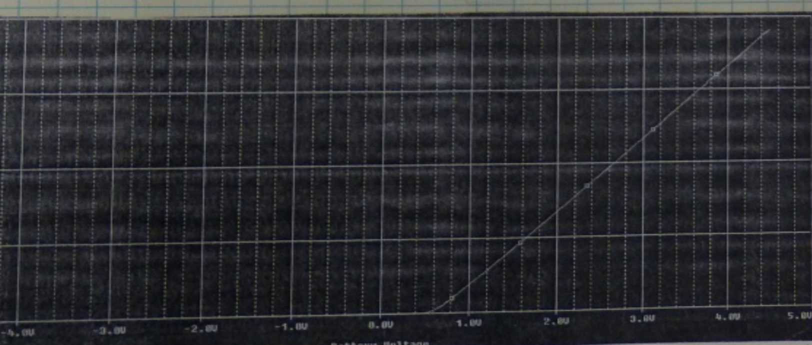
fet chosen:
7210PBF

lation results:

e polarity circuit diagram:

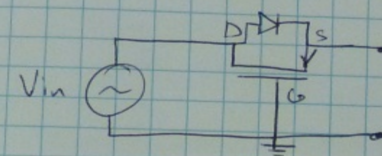


of I vs. V1:



2/12/12 Design Brainstorming of Reverse Polarity / A circuits

Objective: come up with a viable design that can be t PSPICE.



Source: www.youtube.com/watch?v=IrB-FPcv1Dc
SEDRA & SMITH, Microelectronic Circuits

Normal operation: $V_{in} = 4.5$ V

Body diode is on $\Rightarrow$ $V_S \approx 3.5$ V

$V_{GS} = -3.5$ V $< V_t$ (V_t is usu

$\Rightarrow$ Transistor is on

Reverse Polarity operation: $V_{in} = -4.5$ V

Assume body diode is on $\Rightarrow$ $V_S = -5.5$ V

$V_{GS} = 5.5 > V_t$
$\rightarrow$ transistor off $\Rightarrow$
contradicted

Reminder: Get help from TA about explanation for Pow Mosfet. What allows current to flow from $D \rightarrow S$? How to power Mosfet circuits?

– tell Ryan about not being able to attend March 5th me

Why All the Fuss Over a Notebook?

- The notebook is a chronological record of your work
- Maintaining a professional notebook is a critical skill for industry
- The notebook protects your intellectual property
- The notebook provides legal protection in the event of a lawsuit
- The notebook greatly simplifies the writing of the final report
- The notebook is 10% of your final grade for the course (50 points of 500 points)
- Your TA can help push you in the right direction with the help of your notebooks
- **DO NOT NEGLECT THE INFINITELY IMPORTANT NOTEBOOK!**

Go Build (and Document) Something Cool!