

Chapter 10 Wk 5 Wed: bring up and test of brd 1

You should receive your brd 1 example in the lab on Wed. Review your board, take pictures, perform measurements and write up your report. This counts as your midterm. It is due on Monday Sept 27, 9 am.

10.1 What does it mean to work?

Normally, before you design your board, you have a specification of how your board should behave. This is part of the engineering requirements for your board. These define what it means for your board to “work.” When your board is complete, you test your board to these engineering specs.

We jump-started the brd 1 design to get it done quickly. Having completed your board design, what would you list as the engineering requirements to which you would test your board?

Here are examples of some possible specifications:

1. *Board is powered with a 5 V AC to DC regulator.*
2. *There should be an indicator LED turning on when the power is on*
3. *The 555 timer generates a square wave signal with a frequency and duty cycle of about 500 Hz and 70%, depending on what was specifically designed.*
4. *The output of the 555 timer should drive four LEDs of different brightnesses, controlled by resistors.*
5. *The current through one of the LEDs can be measured.*
6. *There are indicator LEDs and switches.*

10.2 Measure key signals

You should measure at least the following signals:

1. *The output voltage of the 555 timer, verifying the frequency, duty cycle and rise time, with no LEDs connected.*
2. *The same measurement with all the LEDs connected. What do you estimate the total current draw to be?*
3. *What do you estimate the Thevenin output resistance of the 555 timer to be based on the open circuit voltage and the loaded voltage.*
4. *The current through one of the LEDs.*
5. *The switching noise voltage on the 5 V power rail, synchronous with the 555 switching signal*
6. *Estimate the current through each of the four different LEDs based on the output voltage, the forward drop across the LED and the value of the resistors.*
7. *Do you have any recommendations on the minimum current through an LED to make it visible as an indicator light? Remember, the duty cycle of the LEDs is only about 70%.*

10.3 Final report for brd 1 and grading rubric:

In your report, which should be < 5 pages, you should include:

2 points for:

- *1 sketch of the schematic you started with*
- *The actual schematic capture used in Altium Designer*
- *The board layout you ended up with*
- *A picture of your board*
- *A picture of your assembled board (maybe with lights on)*

2 points for:

- *An analysis of the performance of your board compared with what you expected (the engineering specs). Include scope measurements as appropriate.*

1 point for:

Your evaluation of what went right and what went wrong in your board design process. What would you do differently next time if you could do this board over? Were there any hard errors you had to fix? Any soft errors? What would you do differently to make your board easier to test?

Remember, your report would look great in your portfolio. This is an example of the design flow from concept to holding a working board in your hand. Show it off.