

# PCB Tiny Gadget

## Due Date:

Refer to the assignment on Canvas.

## Submission format/naming:

Submit single .zip file labeled Team[*yourteamletter*]*\_yourandrewid\_*TinyGadget.zip, e.g.,  
**TeamB\_asolorza\_TinyGadget.zip**.

## Purpose:

Learn the basics of schematic capture and PCB layout design software. You will also get familiar with creating custom libraries for basic components in the design software.

## Teamwork:

This assignment should be completed individually.

## Software:

Download and install [CadSoft EAGLE 8.3](#). This is a free software package with certain limitations but it is more than enough for our purposes.

## Background

Integrated schematic and layout editors like Altium, Eagle, Protel, and OrCAD are important tools for gadget designers. These tools allow you to create a logical representation of your design using the schematic editor, and then create a physical layout of that design. They also allow you to make manufacturing files, which are used by manufacturers to print your circuit board. Many of these packages cost thousands of dollars, but fortunately Eagle offers a limited-functionality freeware version. Unfortunately, (for you), Eagle takes a little while to get used to; thus, the following assignment.

## STEP #1: Making a Through Hole Gadget

We would like you to **(1)** make an Eagle schematic of the hand drawing attached to this assignment. Let's call it the *Tiny Gadget*. Eagle has hundreds of parts libraries from which you can pull parts; fortunately, all of the parts necessary for your schematic are in one library, **TinyGadget.lbr**. It is attached with this assignment on Canvas. After you download the library, remember to add it to Eagle's library directory so it can find it. The schematic that you need to make is found in the References section of this document.

Once you have **(1a)** captured the schematic and it **(1b)** passes the ERC, you need to create a layout. An image of the final tiny-gadget is attached to this document. Try to **(1c)** make your layout as close to this layout image as

possible. The board is 1.5" on a side, and the two holes are 0.125" in diameter. **Note that you do not need to replicate the positions of the red and blue copper traces. You do need to replicate the rough positions of the holes, components, and white text.**

### STEP #2: Making a Surface Mount Gadget

We also would like you to make a **(2) second layout with surface mount parts**. Surface mounted parts are much smaller than the through-hole parts on the tiny gadget. The vast majority of commercial products are now surface mount because they allow for faster assembly and much smaller gadgets. To make the second layout, **(2a)** create a second schematic that is a copy of your first. Now, change the package of all of your parts to be surface mount (type 'change package' and click on a part to see available packages). Once you're done, **(2b)** create a new layout and try to make it as small as possible in square inches. This would be easy except that you need to leave sufficient space for the copper wiring to connect all the signals.

### STEP #3: Making a Custom Library

Finally, **(3) add the following parts to a new library**, using the appropriate package where indicated. You must create these parts from scratch, including the layout. Be sure to include all pads, suitable part outline, part designator and orientation mark (as needed).

- a) The MIC37100 voltage regulator. Use the SOT-223 package on page 14 of:

<http://ww1.microchip.com/downloads/en/DeviceDoc/mic37100.pdf>

- b) The MMA7660 accelerometer. See page 26 of:

[http://www.freescale.com/files/sensors/doc/data\\_sheet/MMA7660FC.pdf](http://www.freescale.com/files/sensors/doc/data_sheet/MMA7660FC.pdf)

<https://www.nxp.com/docs/en/data-sheet/MMA7660FC.pdf>

Note: For this package, ignore the advanced soldermask and fanout instructions in the datasheet.

### Deliverables

Submit single **.zip** file labeled Team[yourteamletter]\_yourandrewid\_Task3.zip, e.g., TeamB\_asolorza\_Task3.zip.

The zip file shall include the following:

1. **yourandrewid-TH.brd** and **yourandrewid-TH.sch** for Through-Hole Tiny Gadget;
2. **yourandrewid-SMD.brd** and **yourandrewid-SMD.sch** for Surface Mount Tiny Gadget;
3. **yourandrewid.lbr** containing the two created library parts.

Submit the **.zip** file on Canvas. Please note: **NO** blanks in filenames, **NO** directories (i.e. only these 5 files should be seen immediately when you extract the .zip file). Do not use **.rar**, **.tgz**, or any other file compression formats.

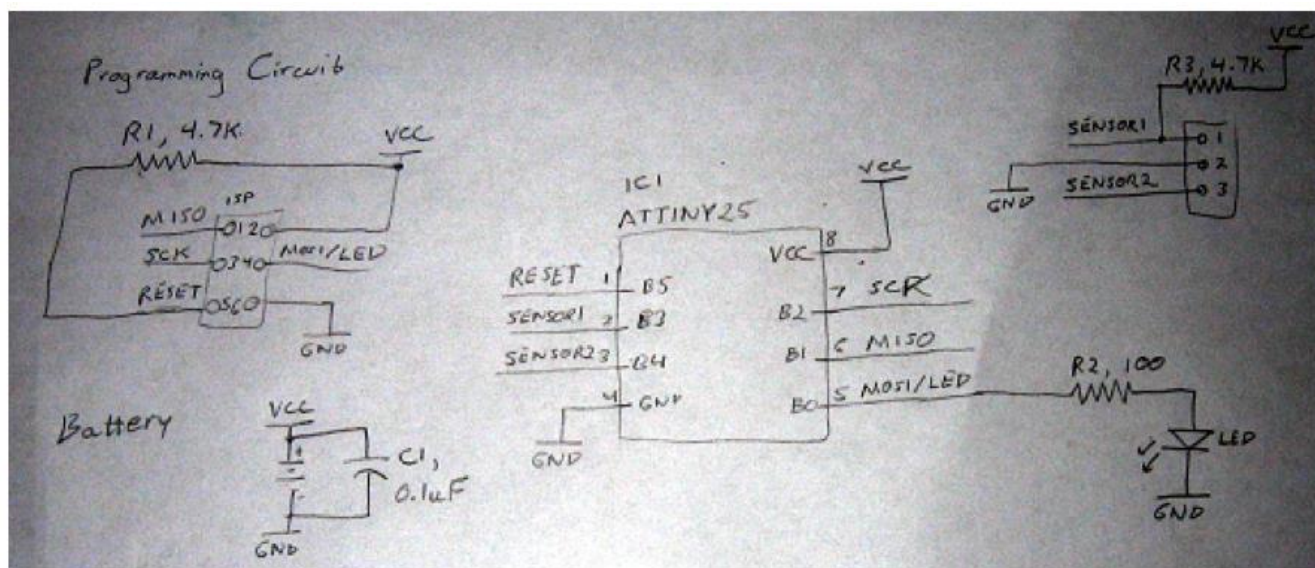
Please check the following the Table, which illustrates some common file naming and content structure errors we have seen in previous years<sup>1</sup>.

<pre> TeamG_qsong1 ├── qsong1.lbr ├── qsong1-SMD.brd ├── qsong1-SMD.sch ├── qsong1-TH.brd └── qsong1-TH.sch </pre>	<pre> TeamH_ijwo ├── ijwo.lbr ├── ijwo-TH.brd ├── step2.brd ├── step2.sch └── task3_step1.sch </pre>	<pre> TeamI_kpage ├── Team[I]_kpage_Task3 │   ├── kpage.lbr │   ├── kpage-SMD.brd │   ├── kpage-SMD.brd │   ├── kpage-SMD.sch │   ├── kpage-TH.brd │   ├── kpage-TH.brd │   └── kpage-TH.sch </pre>
Right	Wrong	

### References:

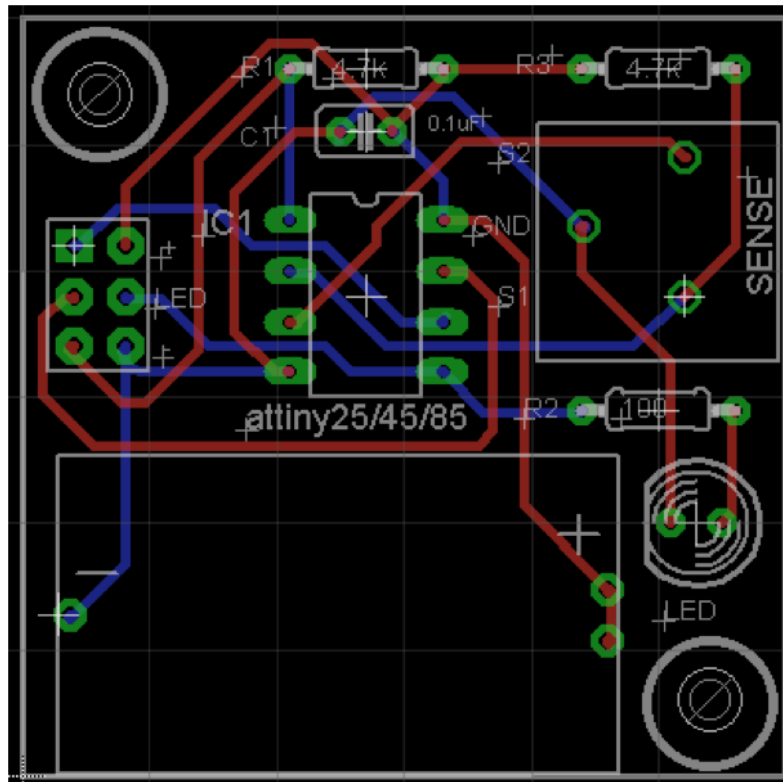
Eagle command references for schematic and layout (EagleCommands.pdf) and for creating library parts (Creating Eagle Parts Libraries.pdf) are attached to the assignment on Canvas.

Additionally, lectures 3.1, 3.2, and 9.1 from the former RI Gadgetry course are attached to the assignment on Canvas and are of use in figuring out Eagle.



**Figure 1.** Schematic drawing for Tiny Gadget. You do not need to replicate the wire positions exactly. However, values, net labels, and component designators should appear in your schematic capture as shown above.

<sup>1</sup> We are not trying to be difficult: we want to instill a strong sense of attention to guidelines that will be useful when you produce and submit your CAD files to the manufacturer in the future.



**Figure 2.** PCB layout for Tiny Gadget. You do not need to replicate the exact positions for the red and blue wires. However, you do need to replicate the text and their placement.