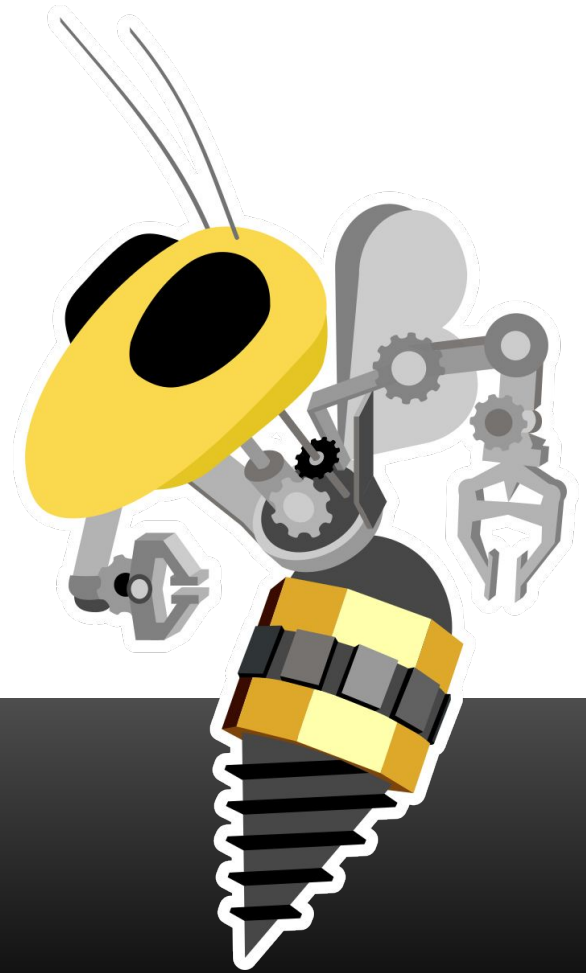


Welcome!

Electrical Training Week 4

ROBOJACKETS
COMPETITIVE ROBOTICS AT GEORGIA TECH

www.robojackets.org



Agenda

- Announcements
- Git
- EAGLE
 - Introduction
 - Parts and Libraries (brief)
 - Schematics
 - Guidelines

Announcements

- We have started publishing videos on YouTube!
 - Please make sure you are on the mailing list
- If you're bored, take a chance to watch the videos on the "Good YouTubers List"
 - GitHub -> Miscellaneous folder



What is EAGLE?

EAGLE

- Software used to make Printed Circuit Boards
- 3 Components
 - Library + Parts
 - Virtual representations of components you put in your circuit
 - Schematic
 - Defines connections between functional units in circuit
 - Board Layout
 - Defines physical locations and sizes of parts

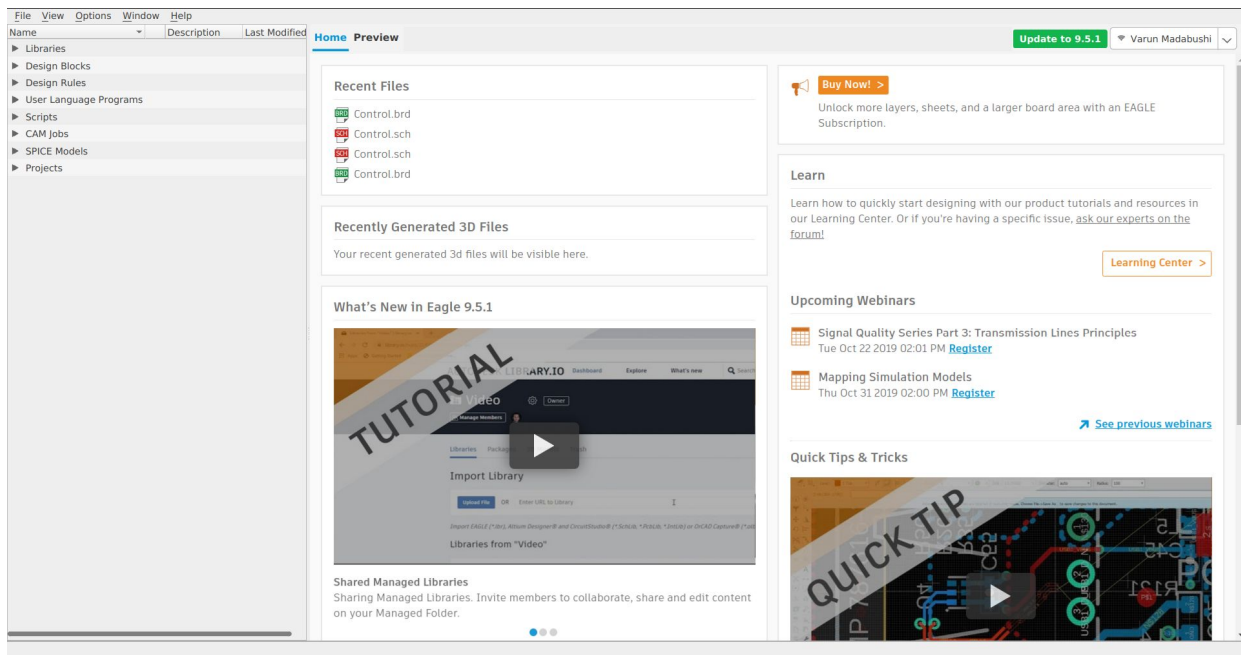
Installation

- Free for students
 - Requires an Autodesk account and GT Email
- <http://www.autodesk.com/education/free-software/eagle>

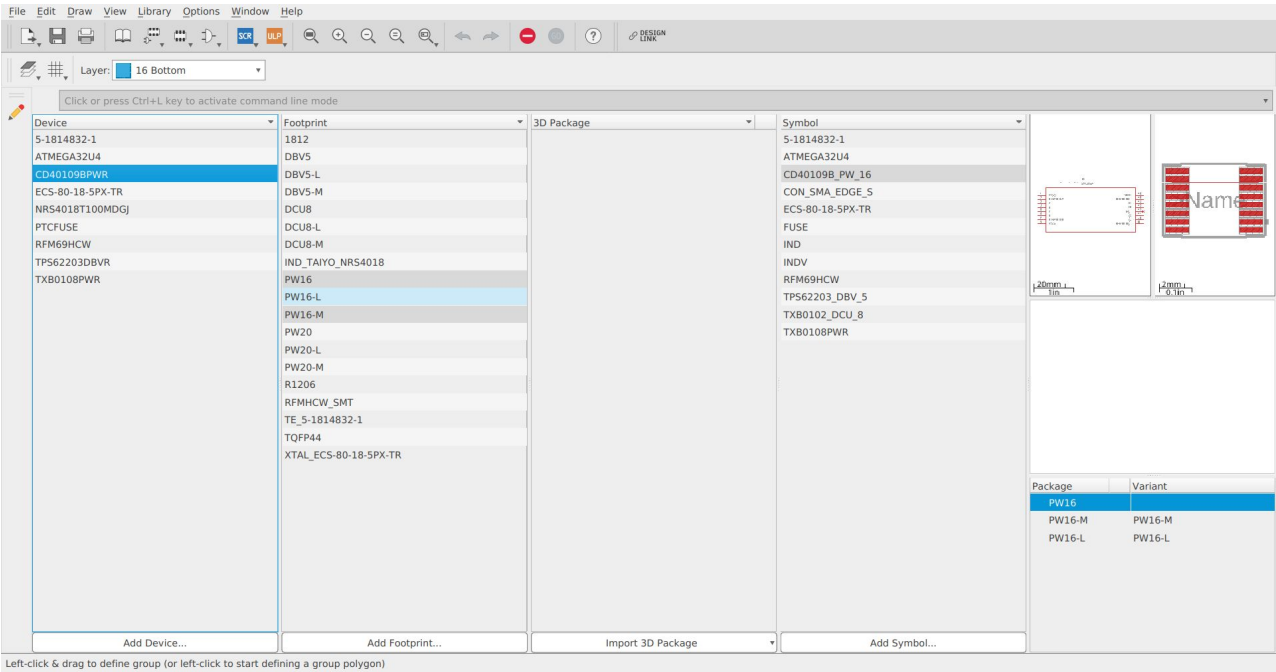


EAGLE Parts and Libraries

Control Panel

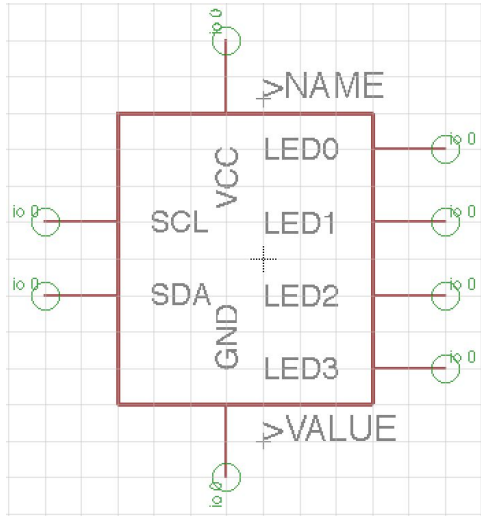


Library (.lbr)

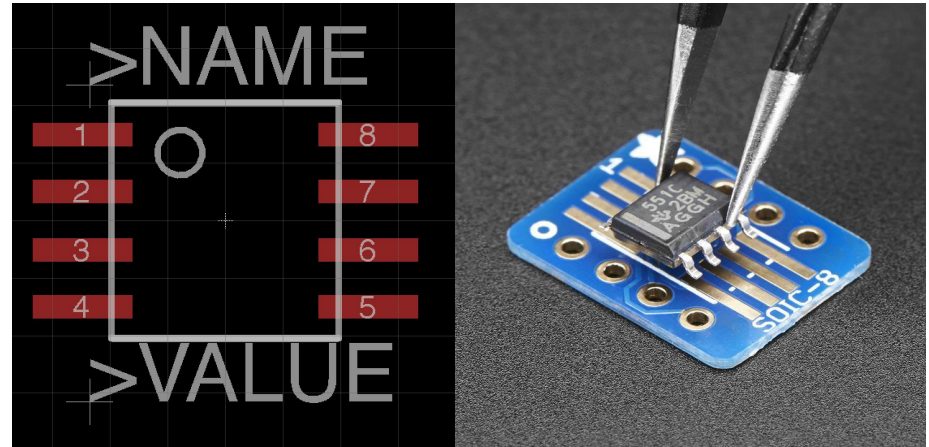


Parts

Symbol



Package



Making Libraries

- Generally want to make one for each project
 - Keeps unique parts together without having to worry about merging
- Can import parts from other libraries through Add Device -> Import

Commonly Used Libraries

- rcl - Resistors, Capacitors, and Inductors of various sizes
- supply, supply2 - Symbols for voltage sources, grounds, and others
- led - assortment of LEDs
- testpad - Test Points and pins

RJ Libraries

- Created a set of libraries to hold some various commonly used parts
- github.com/robojackets/eagle-libraries
- Can pull these files using git to keep a copy on your computer that automatically matches the latest



Git Basics

Source Control Software

Source Control?

- Allows the user to keep track of changes on any code project
 - EAGLE isn't "code" but can be tracked in the same way as it comprises of text
- Once a user makes changes, they can "commit" them
- Changes can be shared among users by "pushing"

Git Terminology

- **Remote:** Internet location where files are stored
- **Local:** The developer's computer
- **Clone:** Put a copy of the remote on the local
- **Pull:** Update the local with the latest version of the remote
- **Push:** Update the remote with your copy of the local (requires special permission)

Git CLI

```
File Edit View Bookmarks Settings Help
varun@varun-Inspiron-15:~/Documents/RoboJackets/eagle-libraries$ git status
On branch master
Your branch is up to date with 'origin/master'.

Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git checkout -- <file>..." to discard changes in working directory)

        modified:   RoboJackets-PowerICs.lbr

no changes added to commit (use "git add" and/or "git commit -a")
varun@varun-Inspiron-15:~/Documents/RoboJackets/eagle-libraries$ git pull
remote: Enumerating objects: 6, done.
remote: Counting objects: 100% (6/6), done.
remote: Total 7 (delta 6), reused 6 (delta 6), pack-reused 1
Unpacking objects: 100% (7/7), done.
From https://github.com/RoboJackets/eagle-libraries
   b1cf9e8..3f67c2c  electrical-training -> origin/electrical-training
Already up to date.
varun@varun-Inspiron-15:~/Documents/RoboJackets/eagle-libraries$
```



PCB : bash

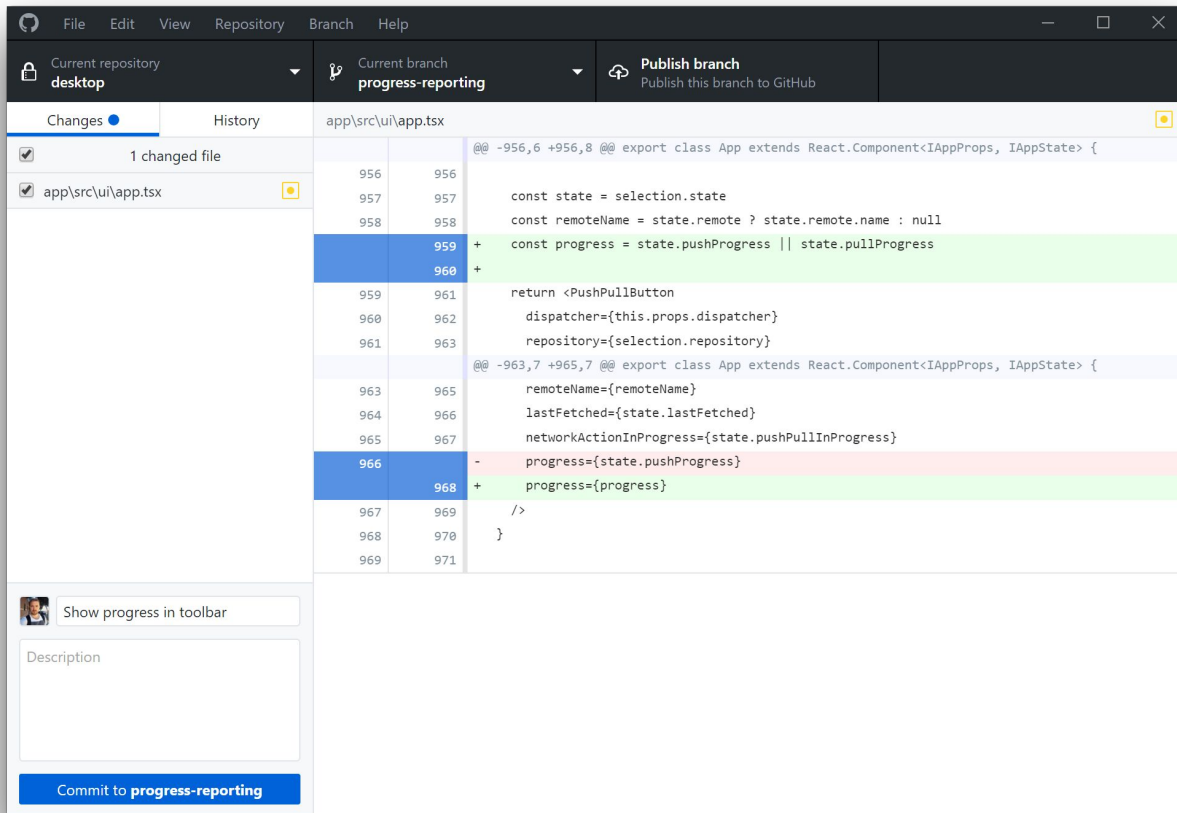


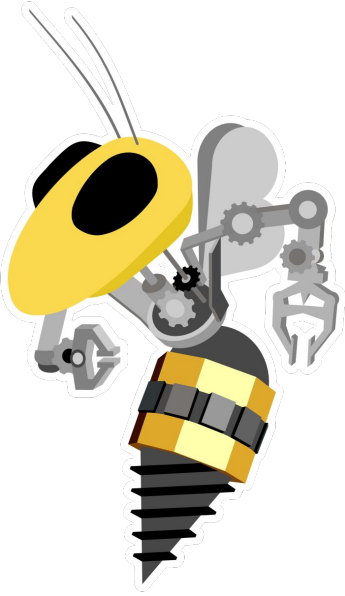
Eagle Files : bash



eagle-libraries : bash

GitHub Desktop app



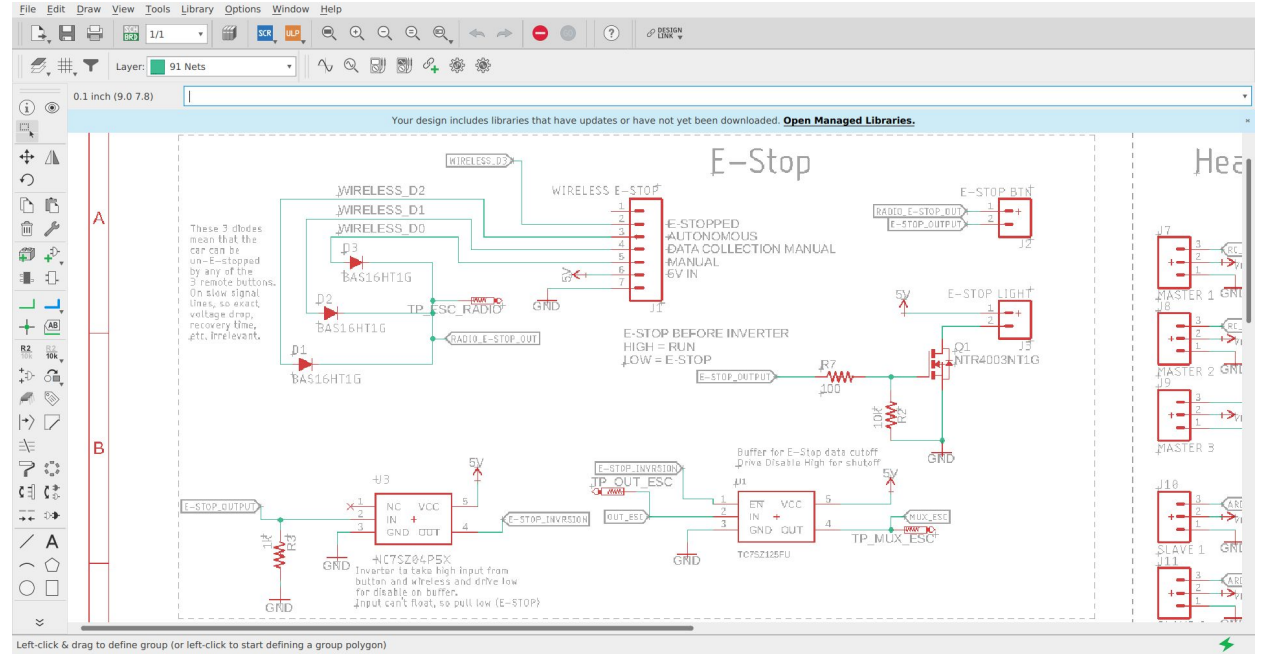


EAGLE Schematics

Creating a Schematic

- From Control Panel, create new schematic (File -> New -> Schematic)
- Place parts on paper using `add` command
- Connect pins on parts together using `net`
- Name nets and implicitly connect them with `name`

Schematic Window




Adding Parts

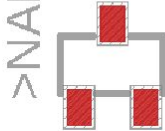
Name	Description
▶ RoboJackets-Capacitors	RoboJackets EAGLE Libraries - Capacitors
▶ RoboJackets-Connectors	RoboJackets EAGLE Libraries - Connectors
▶ RoboJackets-Diodes	RoboJackets EAGLE Libraries - Diodes
▼ RoboJackets-Discrete	RoboJackets EAGLE Libraries - Discrete
AOD1N60	
▶ BJT-NPN_*	
▶ BJT-PNP_*	
BSC072N03LD	
BSS127	
BUK7Y38-100E	
FDBL86361_F085	
▶ FDMS3606	
IRFH7545	
IRFS4227	
IXFT94N30P3	
IXGK400N30A3	
IXGK400N30A3_2	
IXGX400N30A3	
LND150K1-G	
▼ NMOS	
NMOSSOT-23-3	SOT-23-3
NMOSSOT223	SOT223
PHOTOTRANSISTOR	Phototransistor
PMOS	
PSMN014-40YS	N-channel LPAK 40V, 14 mOhm MOSFET

☒ Pads ☒ Smds ☒ Description ☒ Preview

Search

Attributes





2mm
0.1in

NMOS

Footprint: SOT-23-3

Attribute	Value
-----------	-------

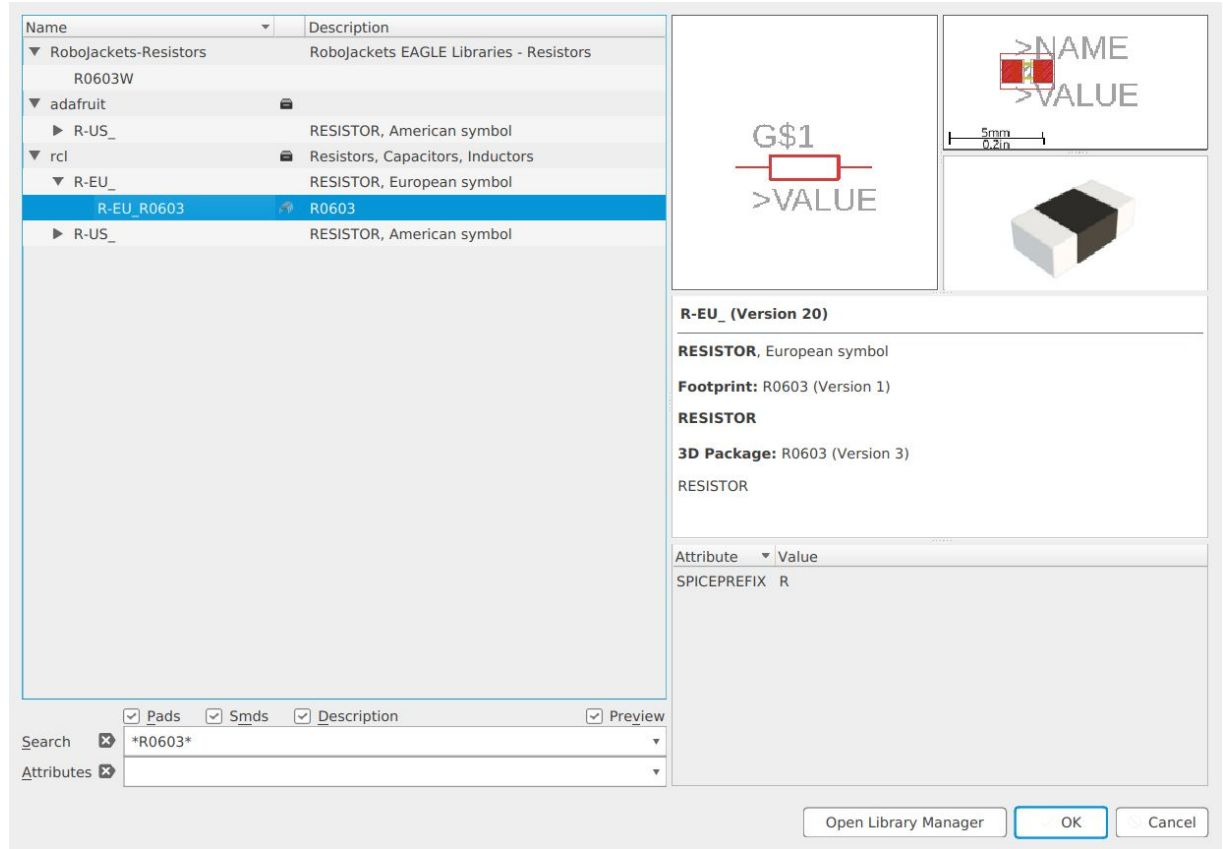
Open Library Manager

OK

Cancel

Searching for Parts

*Use wildcard
character if you
don't have a
perfect match*



EAGLE Resources

- Detailed walkthrough of all EAGLE features
 - /references/eagle_training_guide/eagle_guide.pdf
- Quick “cheat sheet” to look at for command names
 - /references/eagle_training_guide/eagle_cheat_sheet.pdf
- Videos
 - YouTube -> RoboJackets Training -> Playlists -> EAGLE Training

Style Guide

- Defines conventions and best practices for using EAGLE
- Ensures compatibility when transferring EAGLE files across users or teams
- [eagle-libraries/resources/EAGLE Style Guide.pdf](#)



Let's do some EAGLE together!

Please follow along on your own computer or a partner's

Cloning our libraries

1. Find our library on GitHub
 - a. github.com/robojackets/eagle-libraries
2. Copy the URL from the  button

If using Terminal

- Change directory to where you want the folder to exist
 - Ex: `cd ~/Documents/RoboJackets`
- Clone repository
 - `git clone url-of-repo`

File Edit View Search Terminal Help

asha@asha-XPS-13-9380:~\$ cd RJ



asha@asha-XPS-13-9380:~/RJ\$ git clone https://github.com/RoboJackets/eagle-libraries.git

If using GitHub Desktop

1. File > Clone Repository
2. Click URL
3. Paste URL copied from GitHub Website
4. Click “Clone”


Adding Libraries in EAGLE

- In the Control Panel:
Options>Directories
- Change the file path to where
your libraries are located
 - You can add multiple
directory paths, separated
by semicolon (;)
- Click on dot (changes to green)
so the library can be used in
designs

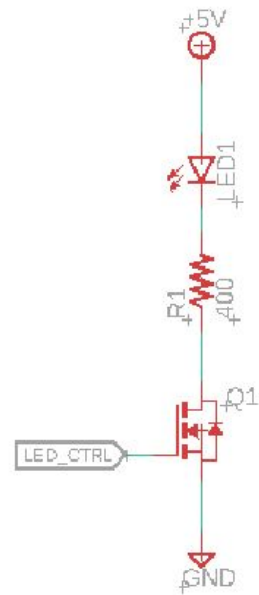
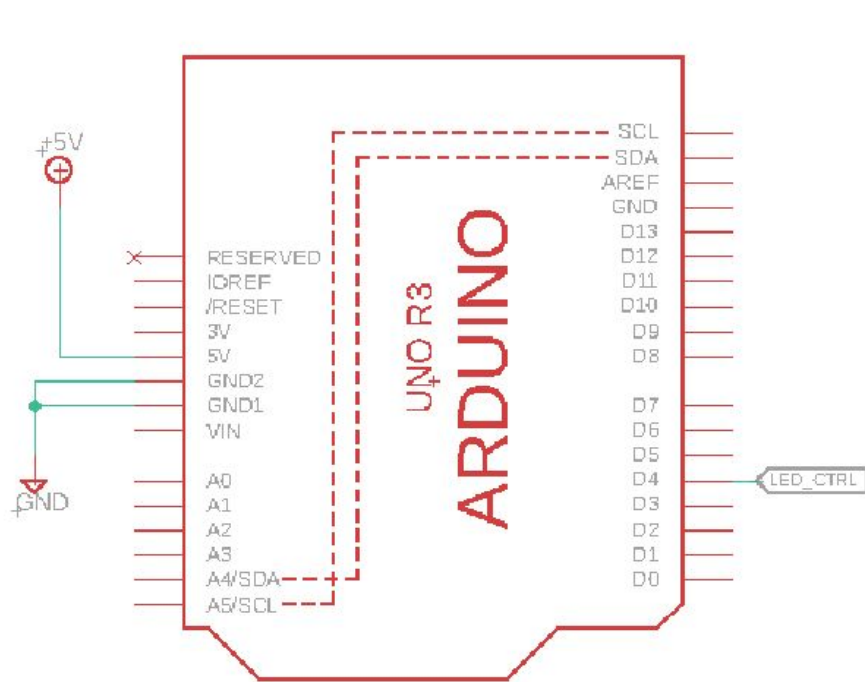
<u>Libraries</u>	\$HOME/RJ/
Design <u>B</u> locks	\$HOME/EAGLE/design blocks
<u>D</u> esign Rules	\$HOME/EAGLE/design rules
<u>U</u> ser Language Programs	\$HOME/EAGLE/ulps
<u>S</u> cripts	\$HOME/EAGLE/scripts
<u>C</u> AM Jobs	\$HOME/EAGLE/cam
<u>P</u> rojects	\$HOME/EAGLE/projects
Simulator Path	\$EAGLEDIR/ngspice/bin
SPICE Models	\$HOME/EAGLE/spice
<input checked="" type="checkbox"/> Include EAGLE examples	
<div>  OK <div> Browse... </div> <div> Set to defaults </div> <div>  Cancel </div> </div>	

[illegible]

Creating a Schematic

- In the Control Panel: File>New>Schematic
- Fun fact: While using EAGLE you must keep the Control Panel Window open (closing it closes your open EAGLE files)
 - Yeah it's stupid
- Check your grid by clicking the  button in the top-left
 - Make sure you are in inches!

Low-Side Switch

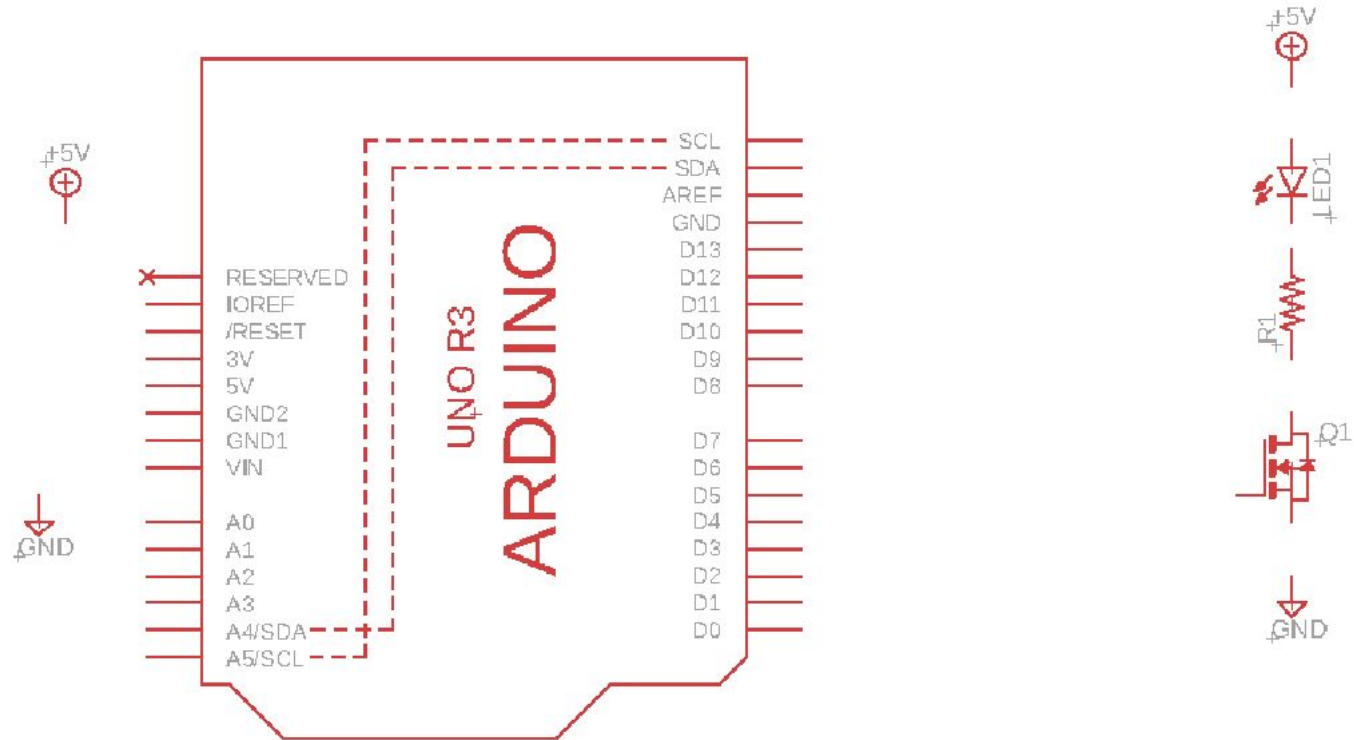


Parts List

- Arduino Uno R3
 - adafruit Library (a managed library)
- LED (0603 package)
 - led library
- Resistor (0603 package)
 - rcl
- N-type Transistor (NFET, SOT2-23 package)
 - RoboJackets-discrete

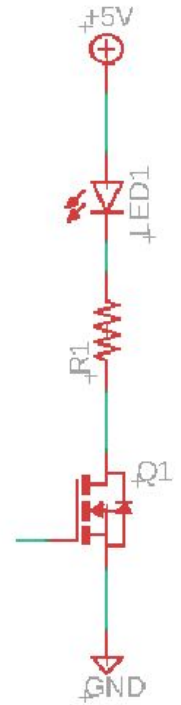
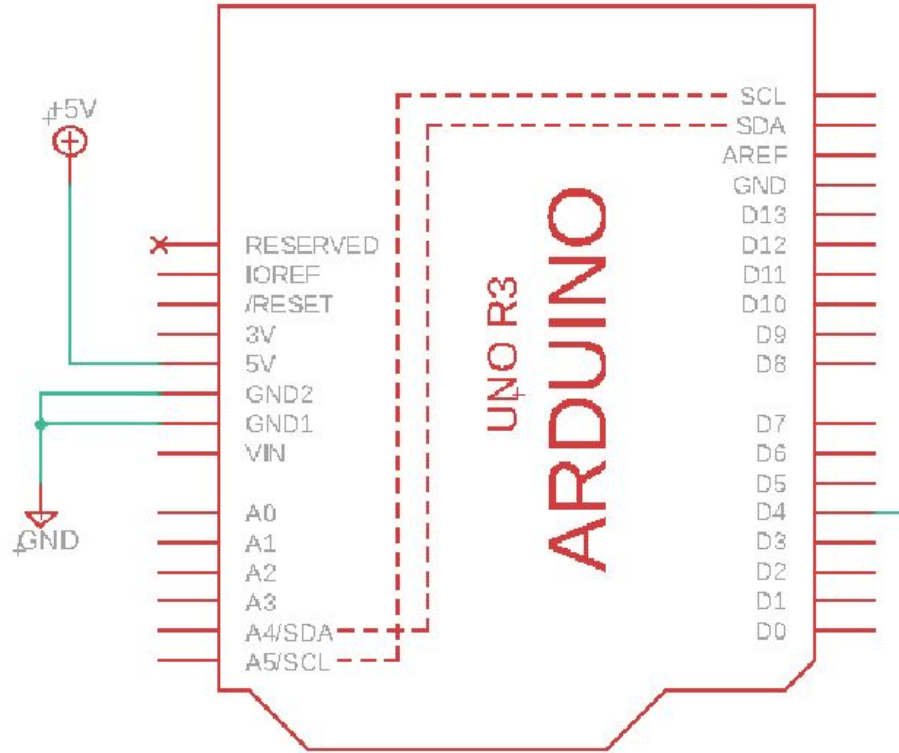
Step 1: Add Components

- Type `add` or press the Add button
- Find all of the following parts and add them to your schematic
- Connect Arduino power to 5V Source
- Arduino Uno R3
 - adafruit library (download from library manager)
- LED (0603 package)
 - led library
- Resistor (0603 package)
 - rcl
- N-type Transistor (NFET, SOT-23-3 package)
 - RoboJackets-discrete



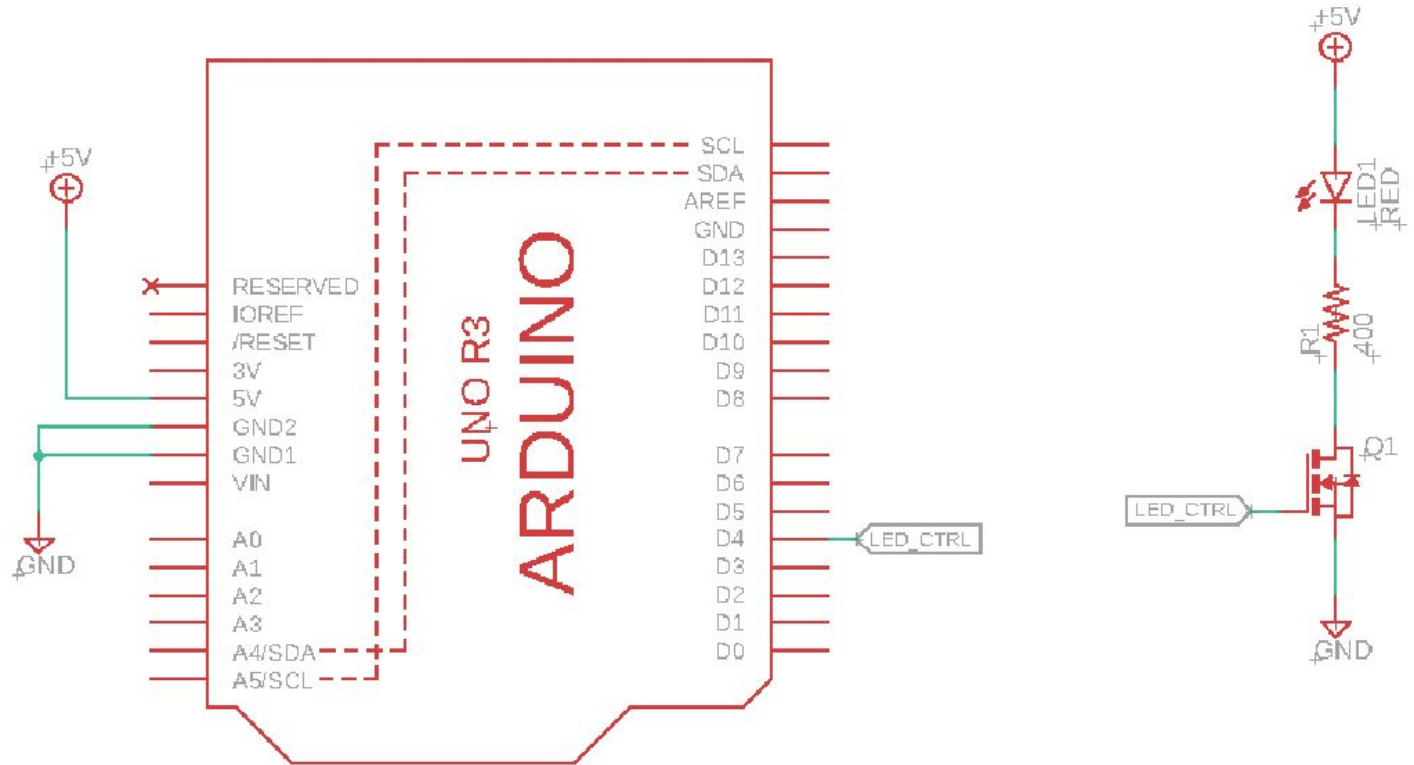
Step 2: Draw nets

- For LED + Resistor + Transistor series circuit:
 - Draw nets by typing `net` or clicking the Net button
 - Click on pins you want to connect
- Connect a 5V supply net and Ground net to the 5V (not VIN) and GND pins on Arduino
- Create short nets sticking out from an Arduino DIO pin and the FET Gate



Step 3: Names and Values

- Implicitly connect the DIO pin on the Arduino to the Transistor's gate
 - Use `name` to give both nets the name `LED_CTRL`
- The resistor needs a value
 - Use `value` to give the resistor a value of 400
- The LED needs a color
 - Use `value` to give the LED a value of RED



Just for fun!

- Click SCH/BRD on top left
- Let's look at the board layout
- We will talk about layouts in a future EAGLE training session