Design Your Own $2 PCB
Is this for real? Five 4”x4” two layer boards for two bucks?

What’s the catch?

1 - 4 Layers
From $2 /5pcs | Build Time: 24 hours
- 1-2L - $2 for 100x100mm PCBs
- 4L - $2 for 50x50mm PCBs
- FR4, Aluminum, Copper, Rogers, PTFE

6 - 20 Layers
From $2 /5pcs | Build Time: 4 days
- 6-8L - $2 for 50x50mm PCBs
- 6-20L - Free via-in-pad with POFV
- Controlled impedance PCB

Flex PCBs
From $15 /5pcs | Build Time: 4 days
- Electro-Deposited (ED) copper
- Support PI, FR4, 3M tape stiffeners
- Support PCB Assembly
Goal

The main goal of the class is to show that anyone can take a little time, design a board and order it.

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https://talk.dallasmakerspace.org/t/breadboard-electronics/104108/6
High-Level Tasks

1. Design schematic
2. Convert to PCB
3. Arrange components
4. Route signals
5. Design rule check, look at 2D & 3D renders
6. Order PCBs
Exercises

Create an account at EasyEDA

Exercise 1: Place and connect a few random parts

Exercise 2: Download schematic parts not placed
Place and connect schematic parts

Exercise 3: Continue or download schematic complete
Run Design Rule Checker
Convert schematic to PCB
Place PCB parts
Try manual routing
Unroute All and run Auto Route

Exercise 4: Continue or download PCB complete
Fabrication / PCB Fabrication – No Generate Gerber
One Click order
Getting Started

EasyEDA documentation

Class is based around this YouTube:
https://www.youtube.com/watch?v=gCwibH1YeiY

Chrome browser is recommended

Create an account at  https://easyeda.com/

For class, choose EasyEDA Designer / STD Edition

File / New Project
   Click frame to set paper size
   600x500 is good for small diagrams
Links

Exercise 2: class_sch_parts_not_placed
https://u.easyeda.com/join?type=project&key=71c6ec33d120dc9745af5f42da2f26a6&inviter=e7e846ad3f354077ad8104a09db976dd

Exercise 3: class_sch_complete
https://u.easyeda.com/join?type=project&key=498ae6466712a53f6416b54ff4ac099d&inviter=e7e846ad3f354077ad8104a09db976dd

Exercise 4: class_final
https://u.easyeda.com/join?type=project&key=32c762f5c18bbebf5ebe82147a485470&inviter=e7e846ad3f354077ad8104a09db976dd
Links

555 simulation
https://u.easyeda.com/join?type=project&amp;key=17bb2d917e8a067d7e9efd856bf73a60&amp;inviter=e7e846ad3f354077ad8104a09db976dd

555 ordered bp4
https://u.easyeda.com/join?type=project&amp;key=3509caef0a07e8a067d7e9efd856bf73a60&amp;inviter=e7e846ad3f354077ad8104a09db976dd
Component Modules

One or more of the following

• Schematic diagram image
• Footprint for PCB
  • Through hole or surface mount
• 2D View
• 3D View
• Simulation
Main Layers of a PCB

Top Silkscreen – Text
Top Solder Mask

Top Copper – Red
Board – Fiberglass – 1.6mm
Bottom Copper – Blue

Bottom Solder Mask
Bottom Silkscreen - Printing
Exercise 1:
Place and connect a few random parts on the schematic screen

File / New Project

Select Commonly Library on left toolbar

Left click a part – do not drag. Left click to place. Right click to end placing the part.

Escape key may not work as expected but Ctrl-Z to Undo works great.

Space bar to rotate
X to reverse horizontal
Y to reverse vertical
Exercise 1: Wiring and Drawing Tools

File / New Project
Exercise 1:
Component Properties Table

Display Name and Prefix can be modified by clicking the text or by changing the table entry,
Exercise 2: Prepare the Schematic

Move parts into position
Rotate as required
Change text and values in schematic and table on right
Exercise 2:

Move parts into position

Rotate as required

Change text and values in schematic and table on right
Exercise 3: Place parts and Route
Exercise 3:

Use your schematic file or download schematic complete file
Run Design Rule Checker
Convert schematic to PCB with Design/ConvertSchematic to PCB – only once
   If you move back to schematic, move forward with Design/Update PCB
Place PCB parts
Text on top silkscreen
Try manual routing
Unroute All
Auto Router
Exercise 3:
Exercise 3: View / 2D & 3D
Exercise 4:
It’s ready...
Prepare and optionally order

Download PCB complete or keep your own

Fabrication / PCB Fabrication – No Generate Gerber

One Click order

Note the price

Colors are neat but add two days

Check out JLCPCB panelize
Default order

Five boards for $3.50 plus tax!

Not bad but you can get more for your money
Panelizing Methods

Order many small size boards – best edges

Panelize in EasyEDA

ThisIsNotRocketScience panelizer – rough but cheap

JLCPCB panelizing – rows and columns on last page
Not well documented but there are a number of YouTubes. There is no extra charge for fabricating such boards.

https://www2.thisisnotrocketscience.nl/software/pcb-panelizer/
Forty boards for $9.20 plus tax
Three Recent Orders

Panelized by JLCPCB – 2 columns – 4 rows
Break apart – 40 small boards for under $10.00

Panelized by Brady with NotRocketScience Panelizer. A little rough but no extra charge.

A basic 100mmx100mm – 4”x4” board
Awesome deal!
PCB Prototype

Order #: Y10-6530726A
Build Time: 2 days
30 pcs $5.70

Product Details

555 Timer_PCB_555 Timer__... Merchandise Total: $5.70

Production Completed Shipping Charge: $1.44

Order Total: $7.14

30 separate 30mmx25mm boards Nice but should have specified rounded the corners
Brady’s Novice Schematic
Perfected by a Real Professional
Paul Urbanus - Easy Lab Board
Paul Urbanus
Assembly Jig and Board

Zip file contains plans for board, jig and sample Python programs.

https://1drv.ms/u/s!AtRNaDxYyK1fjK4JcoUYKcEoKxLsw?e=A1hvNm
LT Spice Simulation

Change STD to SIM after upper left logo

Simulation/Simulation Setting
10m = 10 milliseconds
4s = 4 seconds

Simulation/RunYourSimulation

https://u.easyeda.com/join?type=project&key=d7e9ef856bf73a60&inviter=e7e846ad3f35407dd
555 Timer Chip – Astable Circuit

Wikipedia: In 2017, it was said that over a billion 555 timers are produced annually by some estimates, and that the design was "probably the most popular integrated circuit ever made".

https://en.wikipedia.org/wiki/555_timer_IC

### Astable mode examples with common values

<table>
<thead>
<tr>
<th>Frequency</th>
<th>C</th>
<th>R₁</th>
<th>R₂</th>
<th>Duty cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 Hz (+0.048%)</td>
<td>100 µF</td>
<td>8.2 kΩ</td>
<td>68 kΩ</td>
<td>52.8%</td>
</tr>
<tr>
<td>1 Hz (+0.048%)</td>
<td>10 µF</td>
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