



*“I encourage all FIRST students to check this out.”*  
–Dean Kamen

**FIRST®** has teamed up with **Hack Club** to make **Hack Club OnBoard** available to *FIRST* Robotics Competition and *FIRST* Tech Challenge teams.

- Help recruit new members.
- Energize your team to kick off the year with a fun, technical project.
- Learn new skills in PCB design; manufacture and order your own circuit board business card or other circuit for your *FIRST®* team with a \$100 Hack Club grant.
- Accessible to all team members (electrical, mechanical, fundraising, programming, etc) and no special software needed.
- The first 1,000 projects that complete production will receive a limited edition PCB from *FIRST!*

With **Hack Club OnBoard**, your team members learn circuit design skills, get their projects manufactured and physically shipped to them - all for free with a \$100 grant per student.

Running OnBoard with your team is simple:

1. Host a series of two 60-minute meetings for members to design their own PCB business cards, upload them to Hack Club to receive the grant, and order boards. See **Page 3** for a lesson plan and step-by-step tutorial to use in meetings.
2. Share the suggested copy on **Page 5**, and the poster on **Page 6** with team members.

# Projects Being Built in Hack Club OnBoard



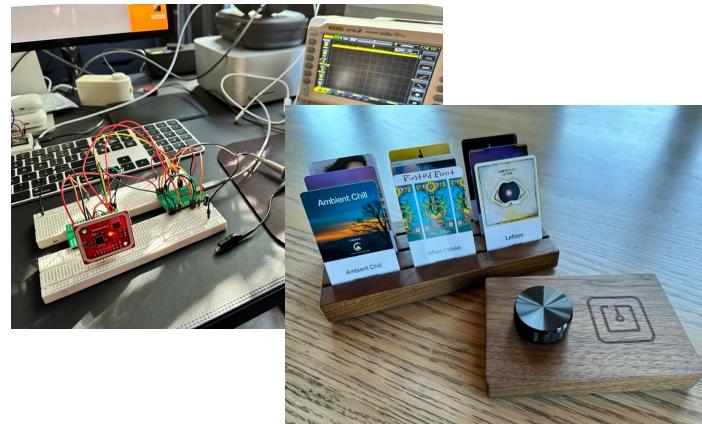
*"I'm so glad that young people can create things like PC boards online. May your creativity have no limits!"*

—Steve Wozniak ("Woz"), Apple co-founder on Hack Club OnBoard

Maggie (17), from California built a circuit board business card that has an NFC tag to her personal website!



Celine (16) is building a musical instrument. It's a MIDI macro pad that connects with software like Logic and Ableton for music production.



Tom Preston-Werner (44), a Hack Club OnBoard mentor, is building Wundercards, a PCB-based home music system that connects to Sonos. He also invented GitHub!



[Hack Club](#) is a 501(c)(3) nonprofit and FIRST® partner with the mission of helping high schoolers fall in love with coding and hardware. Hack Club is completely free thanks to donors who wish they had Hack Club as teenagers.

# OnBoard PCB Lesson Plan

## for FRC & FTC Pre-Season Meetings

### Lesson Objective:

Help recruit new members and energize your team to kick off the year with this fun, technical project! *FIRST* team members can design, manufacture and order their own credit-card size circuit board – Hack Club covers the costs!

### Estimated Time:

2 meetings, 60 minutes each; The entire process from initial design to receiving the finished PCB is about 2-3 weeks (if ordered within the USA; other countries vary).

### Materials:

Internet-capable devices with a keyboard (mobile devices not supported), one per student or one per pair collaborating.

Note: students will be creating accounts with PCB design software and with GitHub. Ensure they use an email account they have access to in order to retrieve their work at any time, and remember their password.

### Note on Grants:

To qualify for Hack Club's \$100 manufacturing grant, projects must adhere to 3 rules:

1. A unique design. For this project, simply adding your own text and art qualifies.
2. Manufactured by an [approved vendor](#). Our tutorial is built using JLCPCB as the vendor.
3. Designed by a high schooler or younger

### Lesson Activity:

You will be following [this workshop](#) created by Hack Club teenager Maggie Liu, which includes step-by-step instructions, [a slideshow](#) (including a customizable [Figma file](#)), and [a video](#). Take a look at it beforehand.

Begin the lesson by sharing examples of items made with PCBs, such as keyboards, your robot's sensors / motor controllers, and computers. Brainstorm design ideas for their cards. Show them the example of another student who built a similar card. Make sure they understand that by completing this project, they'll be eligible for a manufacturing grant to order their own custom-built cards and limited edition PCB trinket from *FIRST*.

## Lesson Activity, continued:

Next, you may want to prime the team with some warmup questions to get them thinking about PCB design. You should adjust these questions to match whatever language you use in your team.

1. What are circuit boards?
2. What are things in your house or school that needed custom-designed circuit boards
3. Where might we be able to use custom circuit-boards within *FIRST*?

It may be tempting at this point to begin a full review of each of these topics, but the workshop will provide students with starting points to kickstart their thinking, and opportunities to explore these topics through trial and error.

Once you've primed the class and they're ready to begin, distribute devices to them so that they can proceed to the [Hack Club PCB Jam](#) and get started!

## **Some basics about structure and flow:**

We recommend you break this into 2 meetings.

- |              |  |
|--------------|--|
| 1st meeting: | Design your PCB board using the workshop: <a href="#">Hack Club PCB Jam</a>              |
| 2nd meeting: | Finish customizing it, and submit the design for manufacturing to receive a \$100 grant. |

## **Here's the basic flow**

1. *FIRST* team member creates a PCB board.
2. They submit their Gerber files via GitHub.
3. The design is checked by a Hack Club staff member and approved.
4. The team member receives a grant for their manufacturing costs via Hack Club.
5. They place the order with one of the approved manufacturers (ex. JLCPCB).
6. The package from the manufacturer goes directly to the team's or team member's door (in USA 2-3 weeks delivery time).
7. The first 1000 completed projects then receive a limited edition PCB from *FIRST*!

### Closure:

Once you reach the end of class and need to start wrapping up, call everyone's attention together for a brief closure discussion.

### Some potential discussion questions could be:

- What did you like about building your first PCB design?
- What do you think of the manufacturing process?
- Which part was your favorite?
- Which part of design challenged you the most?
- What hardware concepts do you feel more comfortable with now?

## Suggested Text to Share With Members

Check out **Hack Club OnBoard** – a *FIRST®* + Hack Club collab to make your own PCB (printed circuit board) project and in return, receive \$100 grants *plus* a custom trinket containing a surprise from *FIRST®*!

PCBs are the basis of modern electronics, and are found in everything from your phones to medical devices to our robot itself! Check out some of the cool projects other teenagers have designed [here](#).

There's a really simple step-by-step tutorial to creating a PCB business card design. It's made for beginners, and great for any level of experience. It should take about 2 hours in total, and all you need is an internet-connected computer!.

Here are the steps to take to get your grant + *FIRST®* trinket:

1. Create a PCB business card design by following [this tutorial](#).  
There's also a video stepping you through it on the "Video" tab.
2. The tutorial walks you through submitting it to Hack Club to get your grant to pay for manufacturing costs. *You can make as many projects as your \$100 budget allows!*
3. Watch your mailbox for your goodies to arrive!

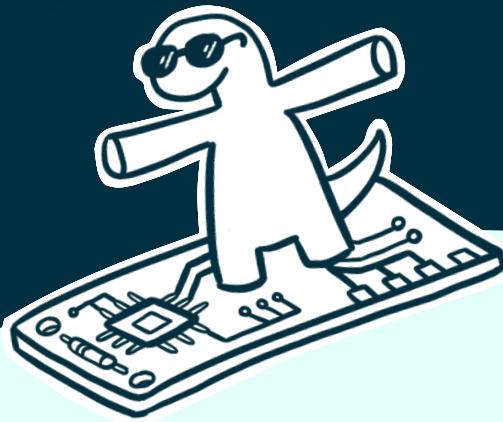
If you have any questions, (COACH'S CONTACT DETAILS). Hack Club also has a team ready to help us out – find them on [the Hack Club Slack](#)

Links:

- [1 minute video about the program](#)
- [Hack Club OnBoard website](#)
- [Link to 2-hour tutorial to create a PCB hacker card](#)

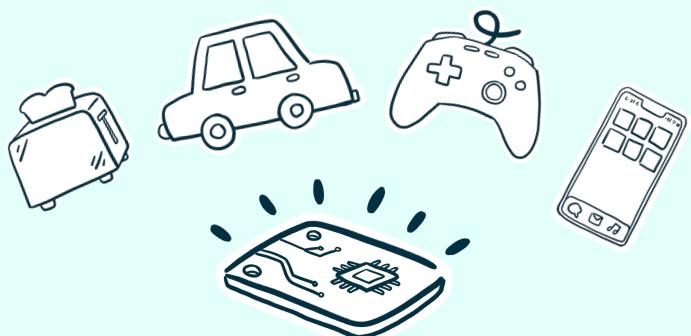
# build circuit boards, for free!

we're giving teens \$100 grants  
plus a custom trinket from FIRST  
to design their own PCBs



## What's a PCB?

Printed circuit boards (PCBs) are the electronics in your phone, laptop, and toaster! They pack components together into a neat, little package.



## Steps

1. Head to [hackclub.com/onboard](https://hackclub.com/onboard)
2. Create a design
3. Submit your circuit board
4. Use your \$100 grant
5. Get your boards in the mail!

## I can make one?

Yes! Circuit making has gotten so good you can now make circuits online, anytime. We'll cover the cost too!

*"I'm so glad that young people can create things like PCBs online. May your creativity have no limits!"*

— Steve Wozniak, Apple co-founder



He's helpin' us out!

## Why circuit boards?

If circuits power the world, then who will power the circuits? That's you! With OnBoard you'll learn to move electrons to make your own electronics!

We have tutorials!

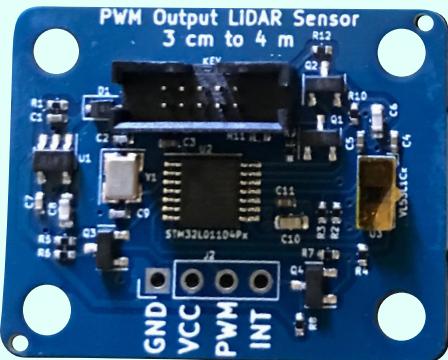
Scan Me!  
Get Your Grant!  
[hackclub.com/onboard](https://hackclub.com/onboard)



HACK CLUB

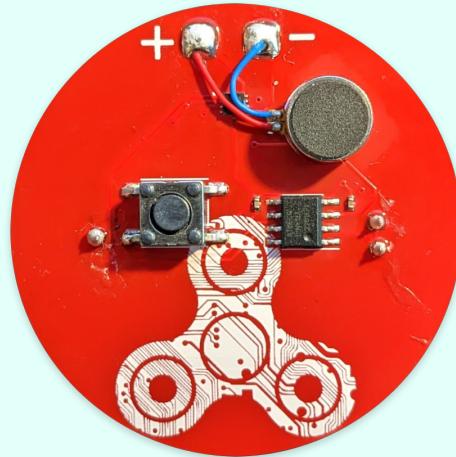
## LIDAR Sensor

Thomas, 17, designed his own range sensor! He's using it to build robots!



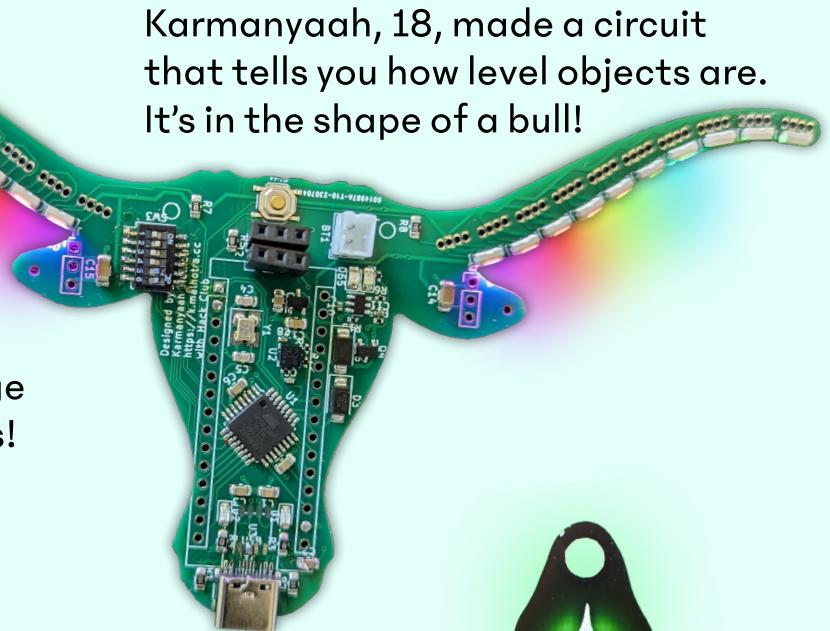
## Electric Fidget Spinner

Micha, 15, wanted a quiet fidget spinner so he made it electric! It fidgets with a vibrating motor.



## Digital Level

Karmanyah, 18, made a circuit that tells you how level objects are. It's in the shape of a bull!



## PCB Keychain

Maggie, 17, made a light-up keychain! It's in the shape of our mascot, Orpheus!



see what teenagers  
have built!

all projects are  
open source

[github.com/hackclub/onboard](https://github.com/hackclub/onboard)