

The Arduboy Story



What is Arduboy?

- 8-bit gaming system
- Credit card size
- Open source
- Based on Arduino
- Launched on Kickstarter 10 years ago



What is Arduboy?

- 20,000+ units sold
- 400+ homebrew games
- Made by members of the community
- All free and all open source



categories ▾

Categories

Latest

Category

Arduboy

A space for all things Arduboy

■ Homemade 4 unread ■ Wish List

Games



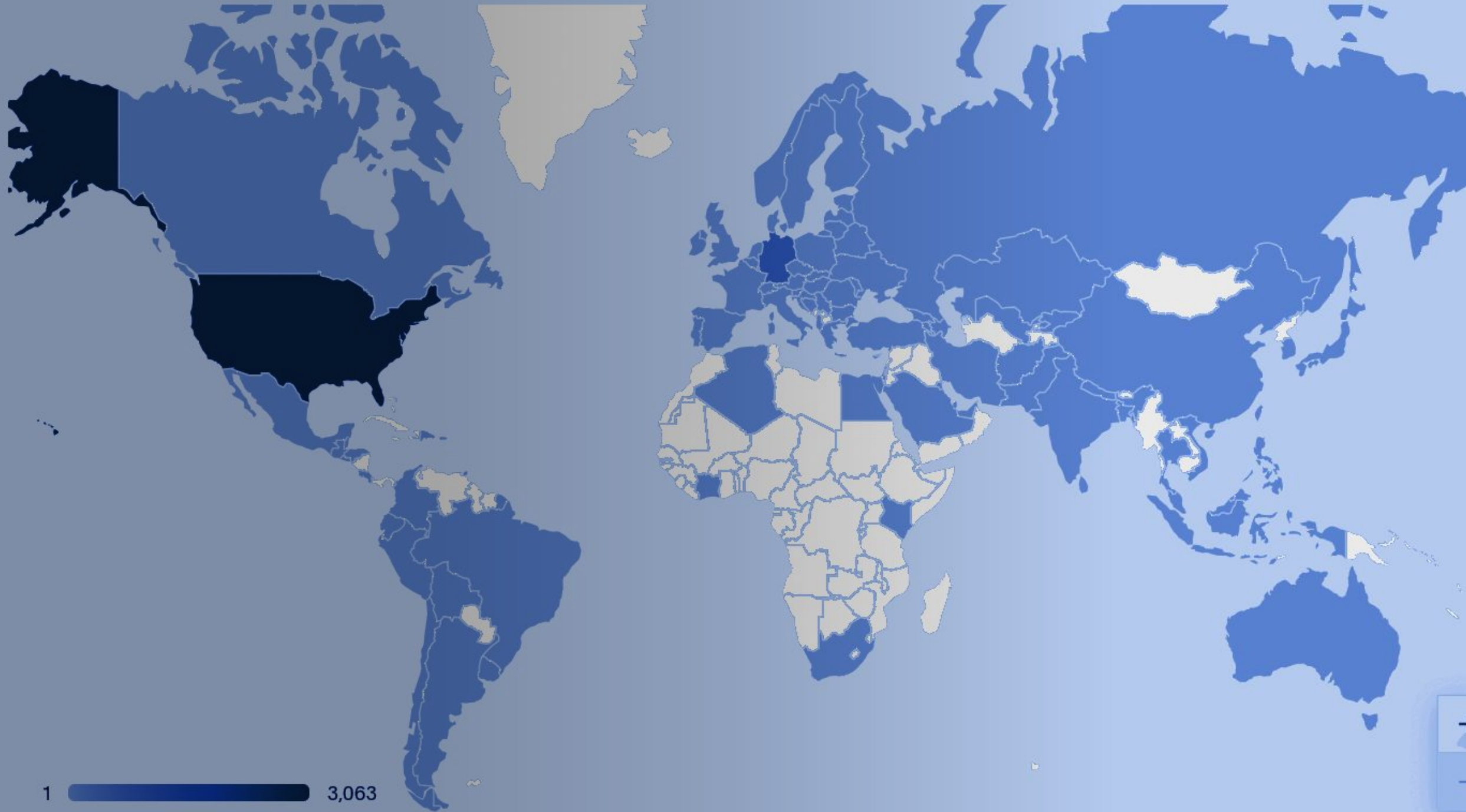
Browse,
share and
play gam
made by
the
communi

■ Demos 6 unread ■ Game Jam 1 ■ Game Jam 2
■ Game Jam 3 7 unread ■ Game Jam 4 ■ Game Jam 5
■ FX Game Jam ■ Meme Jam

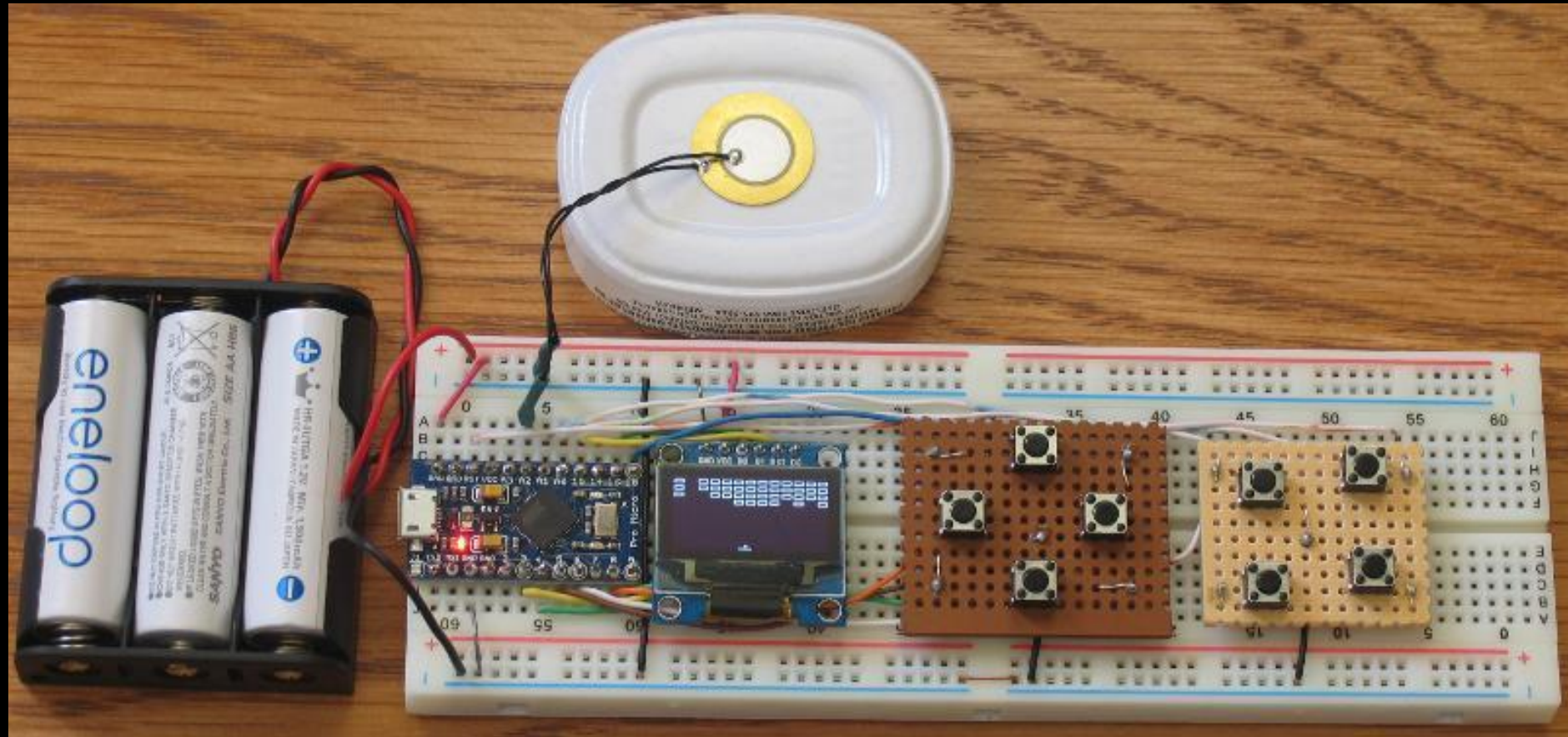
Development

Community

- 10,000+ daily page visits
- 40+ daily engaged users



\$12 DIY Arduboy



How to make a game?

- Programming: Arduino IDE C++, Rust
- ABC (bespoke scripting language)
- Fully optimized community developed library
- Online tutorials in the community





Dark and Under II

Where the magic happens

- Thinking outside of the box
- Making games for PC or console requires massive resources to push boundaries
- Arduboy shrinks the box
- Anyone can do something creative and new with Arduboy



Me: Kevin Bates

Education: Oregon State

- Mechanical Engineering & Business Management

Turbo Kit Salesman

- Sold parts for race cars, "Fast and Furious"



Wind Turbine Technician

- Traveled the world climbing 150 feet in the air to troubleshoot/repair



Wind Turbines

- Multimillion dollar machines, controlled by tiny single chip computers



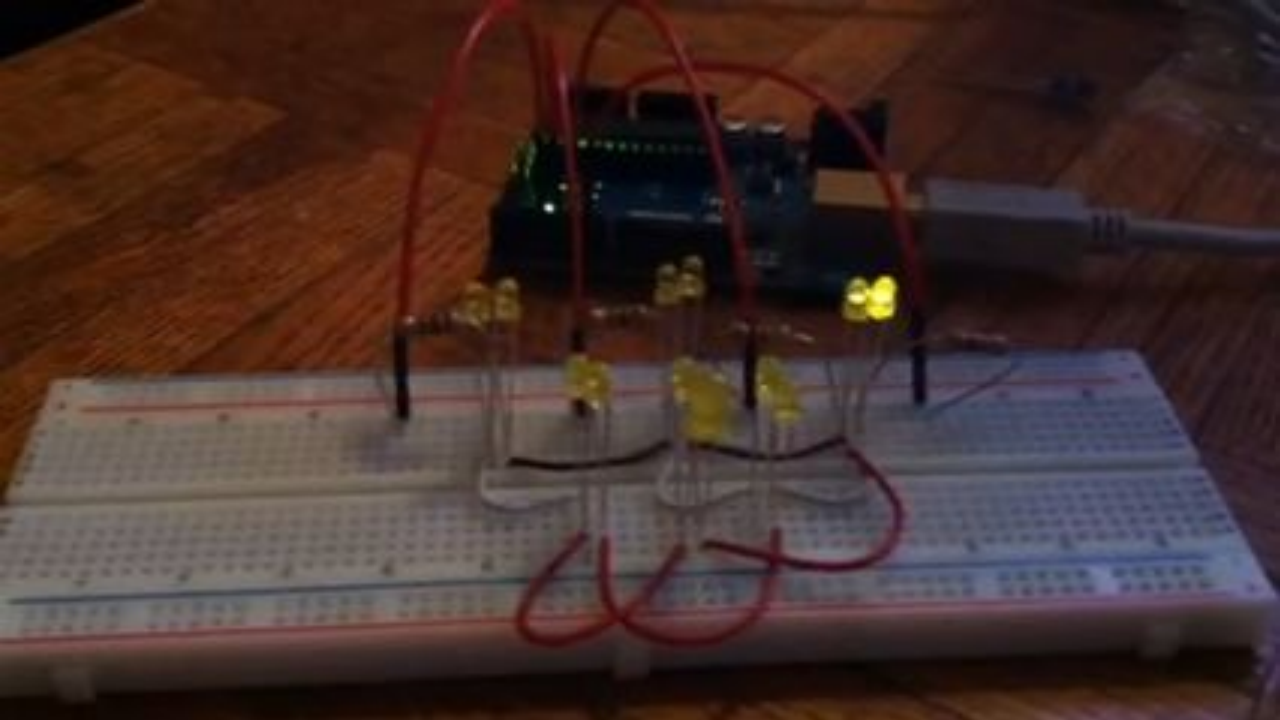
How can I do this?

- Arduino became popular around the same time ~2008



Why Arduino?

- Easy to set up, single install
- USB boot loading
- Massive community with tutorials
- Libraries with examples



Digital Business Card

- Are business cards still a thing?
- Others had created digital business cards before
- This is what I do

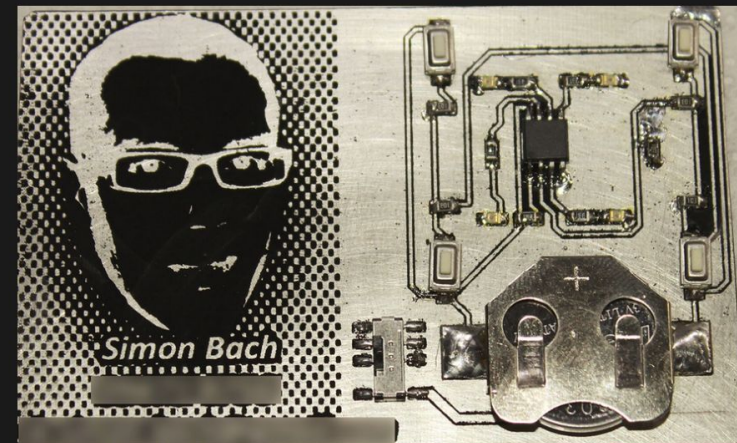
A BUSINESS CARD THAT PLAYS SIMON SAYS

by: [Kevin Darrah](#)

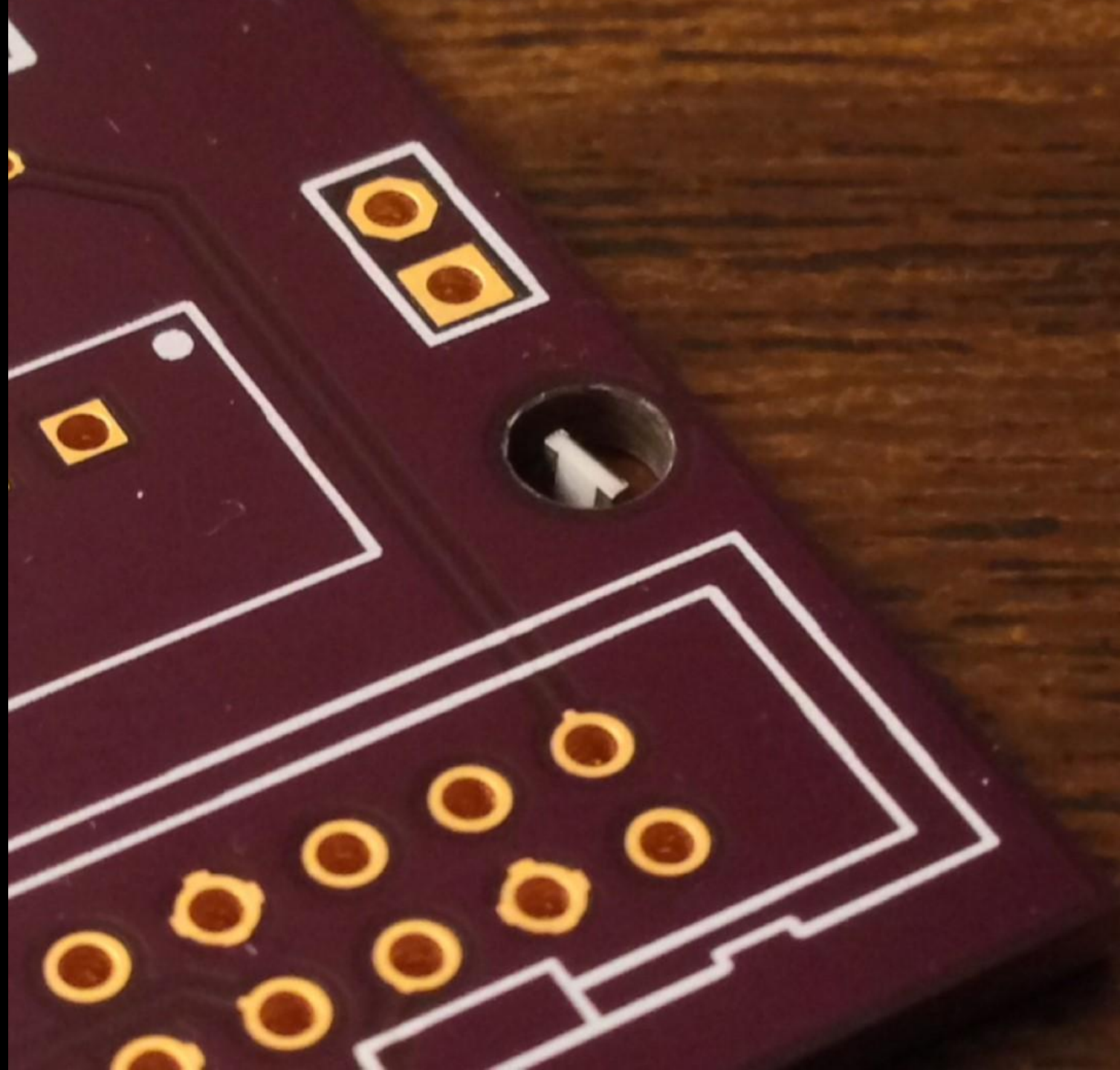
[16 Comments](#)



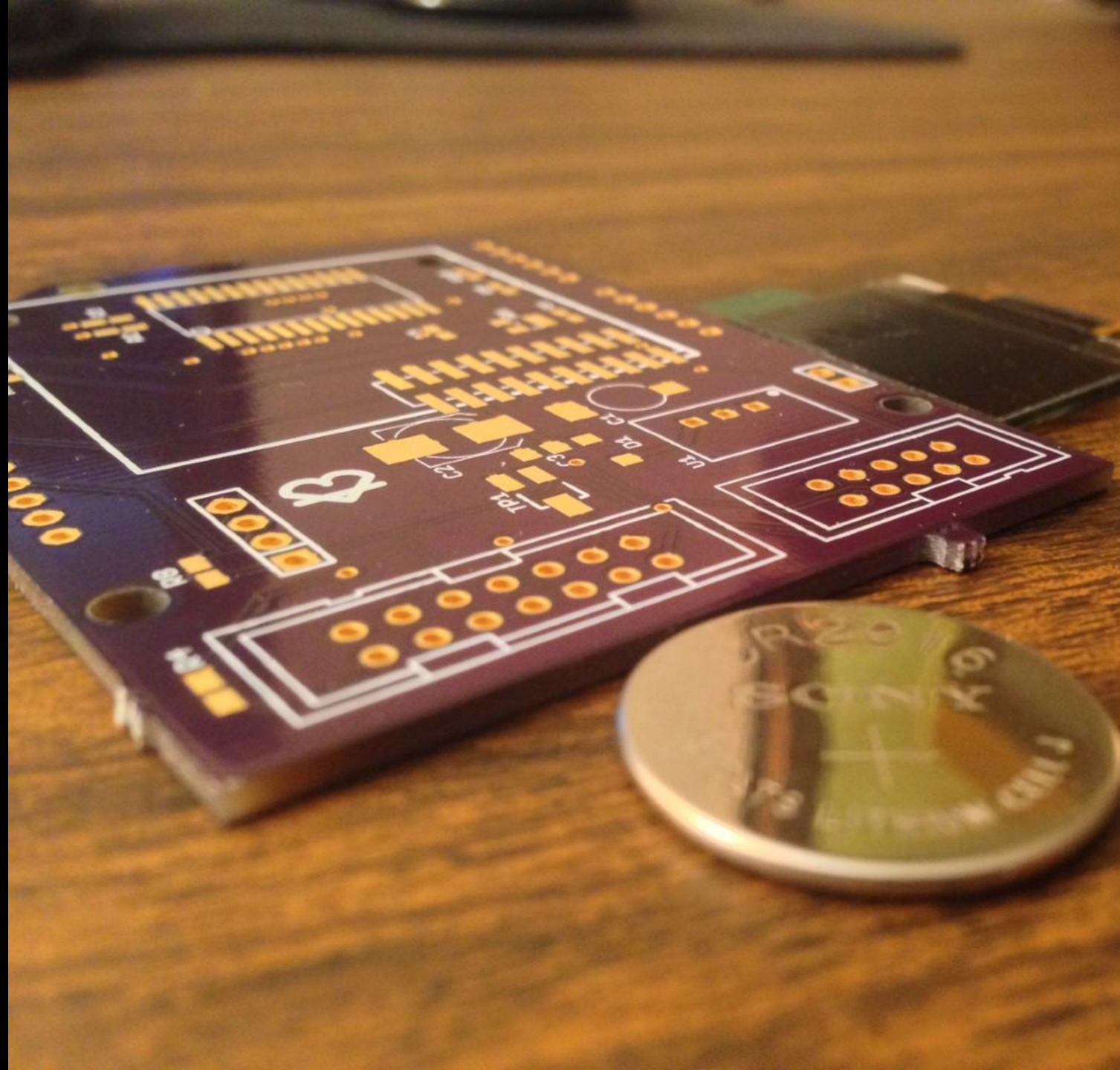
January 10, 2014



Embedded Component

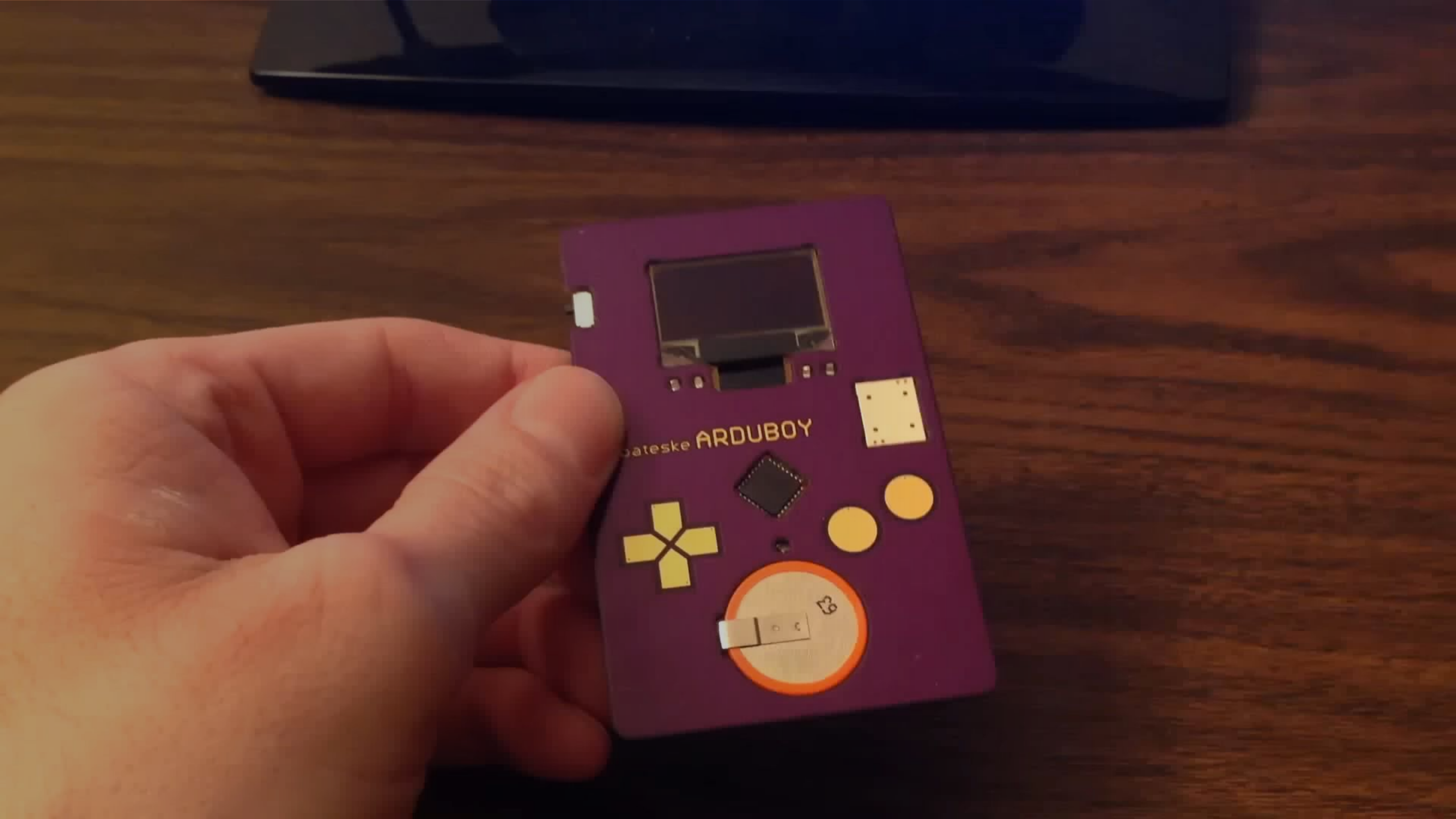


Slim Design



Advanced Concepts





Gateske ARDUBOY

Goals

- Get on Hackaday / Adafruit Blog
- Meet a few people on the internet to make games with
- Get a cool job



HACKADAY

Going Viral

- Covered by virtually every news media outlet on the planet
- Global reach, published in virtually every language and region



HUFFINGTON POST

TIME



EE|Times

ADWEEK

GIZMODO

People



PEREZHILTON



YAHOO!

Now what?

- Most amazing thing that has ever happened to me
- Cats do stupid things and are way more popular
- Opportunity to seize the moment, make the world a better place



30 Minute Call

- Received a cold email offer for investment
- Shared vision of education, importance of learning to code
- The company at this point was a laptop and a YouTube video.



Bay Area Maker Faire 2014

- There is a real audience for this stuff
- They have money
- They want to give it to me
- This could be better than my day job



Advice

Advice is neither good nor bad, it's your job as CEO to decide.

- Gordan Hoffman, advisor

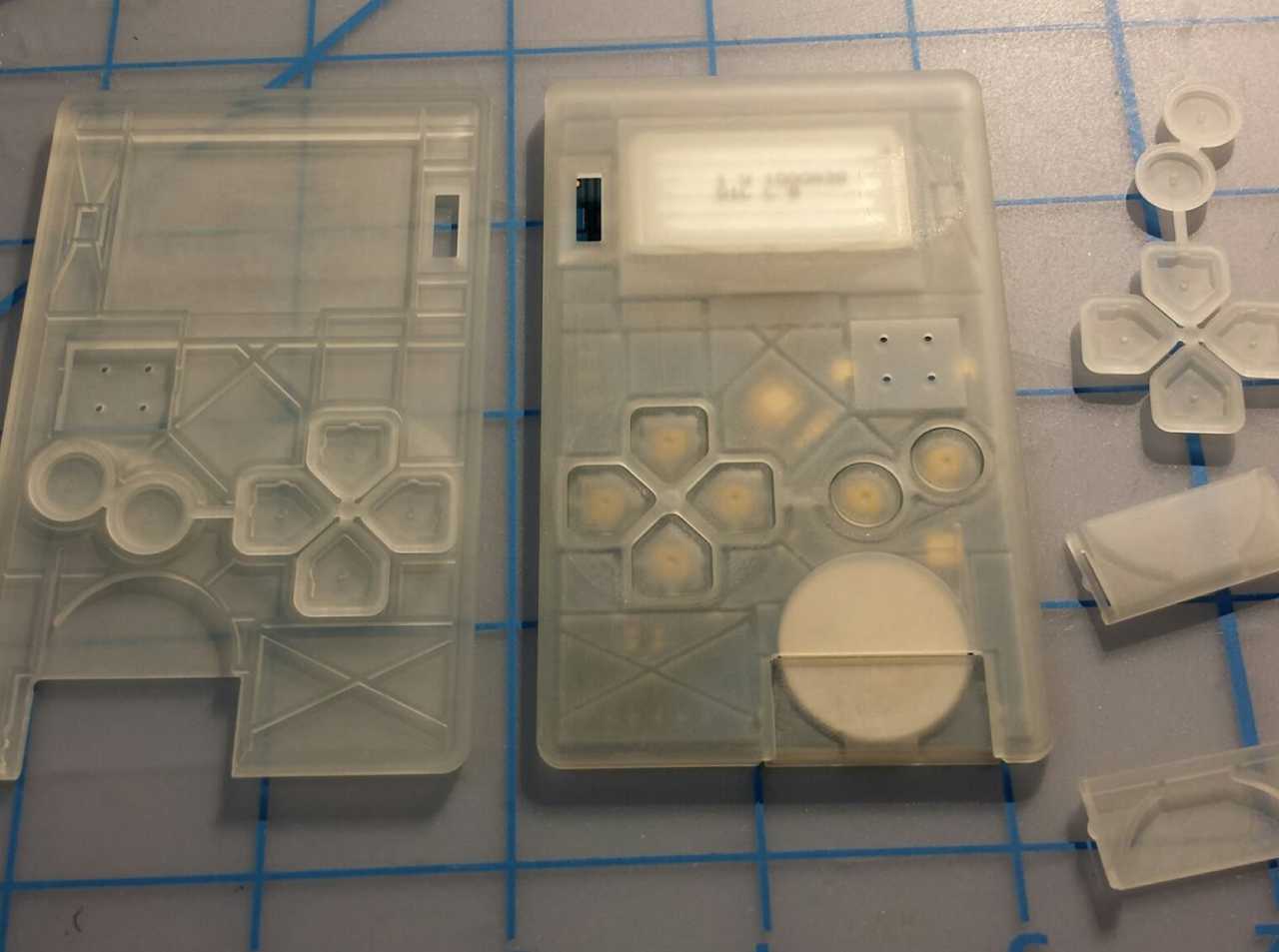
Most people wait too long, and the opportunity becomes stale

- Jerry Carleton, lawyer

Working in CAD

- Hired mechanical engineer Bill McDonough to work the CAD
- 20 years experience in medical technology
- 100 hours on buttons alone





Clear Front Cover & Glue

HAX

- Met Zach Supalla (Spark now Particle) at OSCON 2014
- Had a prototype I felt was ready, but didn't know where to start
- Asked for money, got advice
- Suggested I apply to HAX



What I knew about HAX

- Hardware incubator/accelerator
- Offering investment
- Other companies I knew and liked went through the program
- Filmed a 5 minute video and 2 skype calls

What I did not know about HAX

The entire program takes place over 4 months in
Shenzhen, China

Pack it up

- Applied in October
- Interviewed in November
- Accepted in December
- One way ticket to China in January



China

Terribly Awesome, Awesomely Terrible

我爱中国, 中国爱我



Should have seen it coming

- First investor told me to go to China
- “No, because email”
- Anyways, I was wrong



HAX Program

- 6-week incubator/accelerator
- Each week has a milestone
- Every 2 weeks has a presentation w/ prototype



Resources

- Investment
- Visa support, office space, workshop, translators, sourcing agents, mechanical engineers, factory contacts
- Mentors



Bunnie Huang

- Hacked the Xbox
- Designed Chumby, Novena, Precursor
- Has shared almost everything he has learned about designing and manufacturing



Huaqiangbei Markets

- Each booth represents a factory
- This is what they will tell you, sometimes true but often not
- Know a guy, who knows a guy



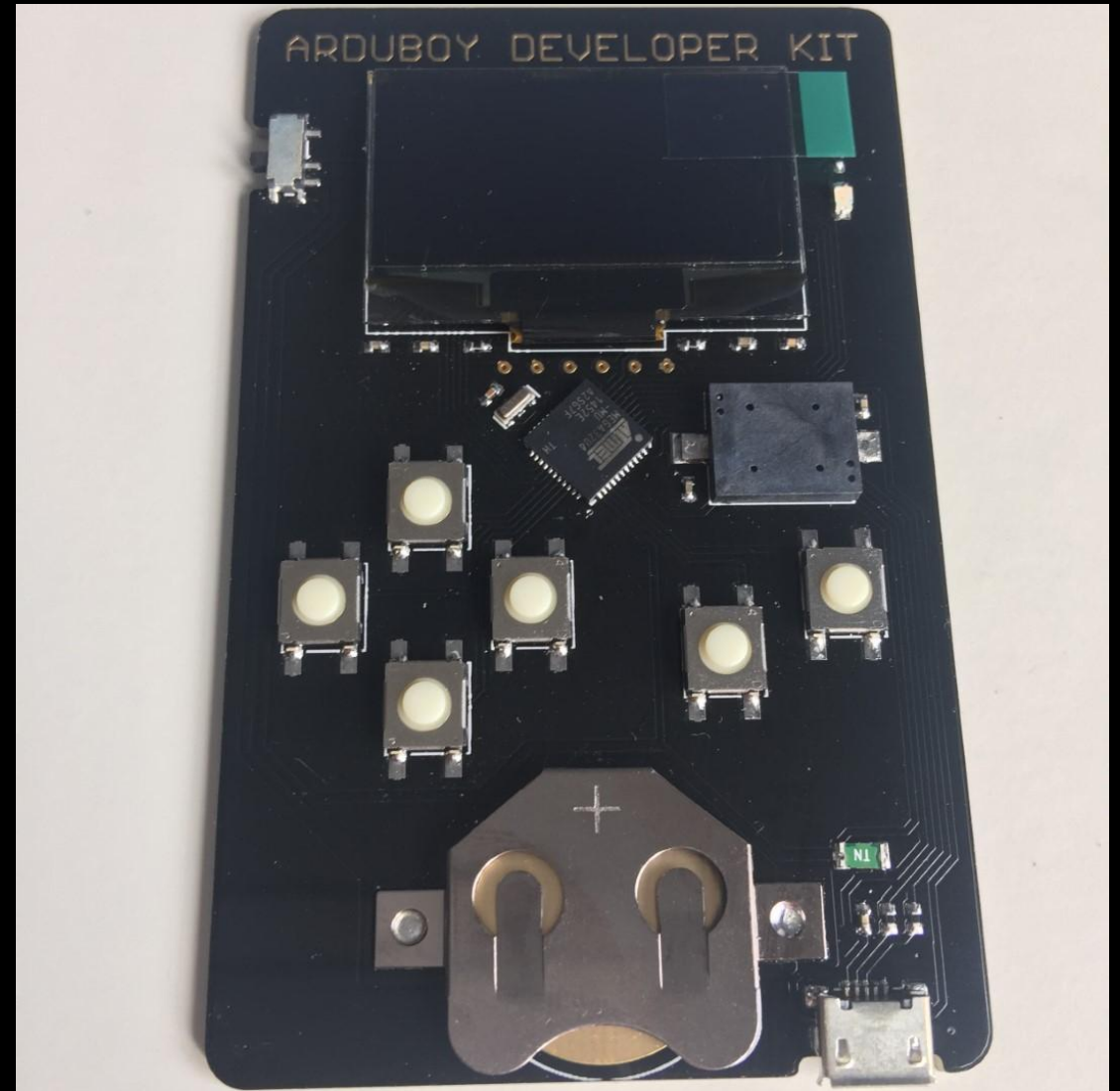
Great For Prototyping

- Easily browse options
- Touch and feel
- Get samples right now
- Customization



Dev Kit First Edition

- Started library and game development
- Feedback on hardware
- Get it out there



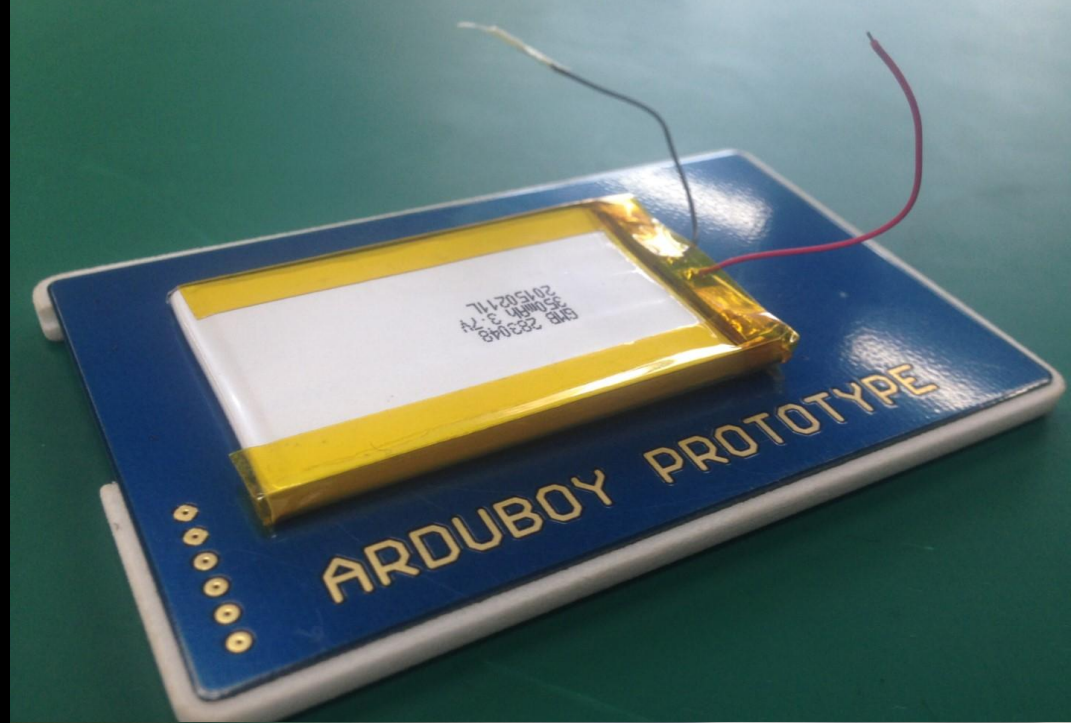
Dev Kit Fulfillment

- Sold 100pcs
- From a waiting list of over 100k



Lithium Ion Polymer

- Testing with rechargeable batteries
- Big unknown
- Chance discovery



ARDUBOY

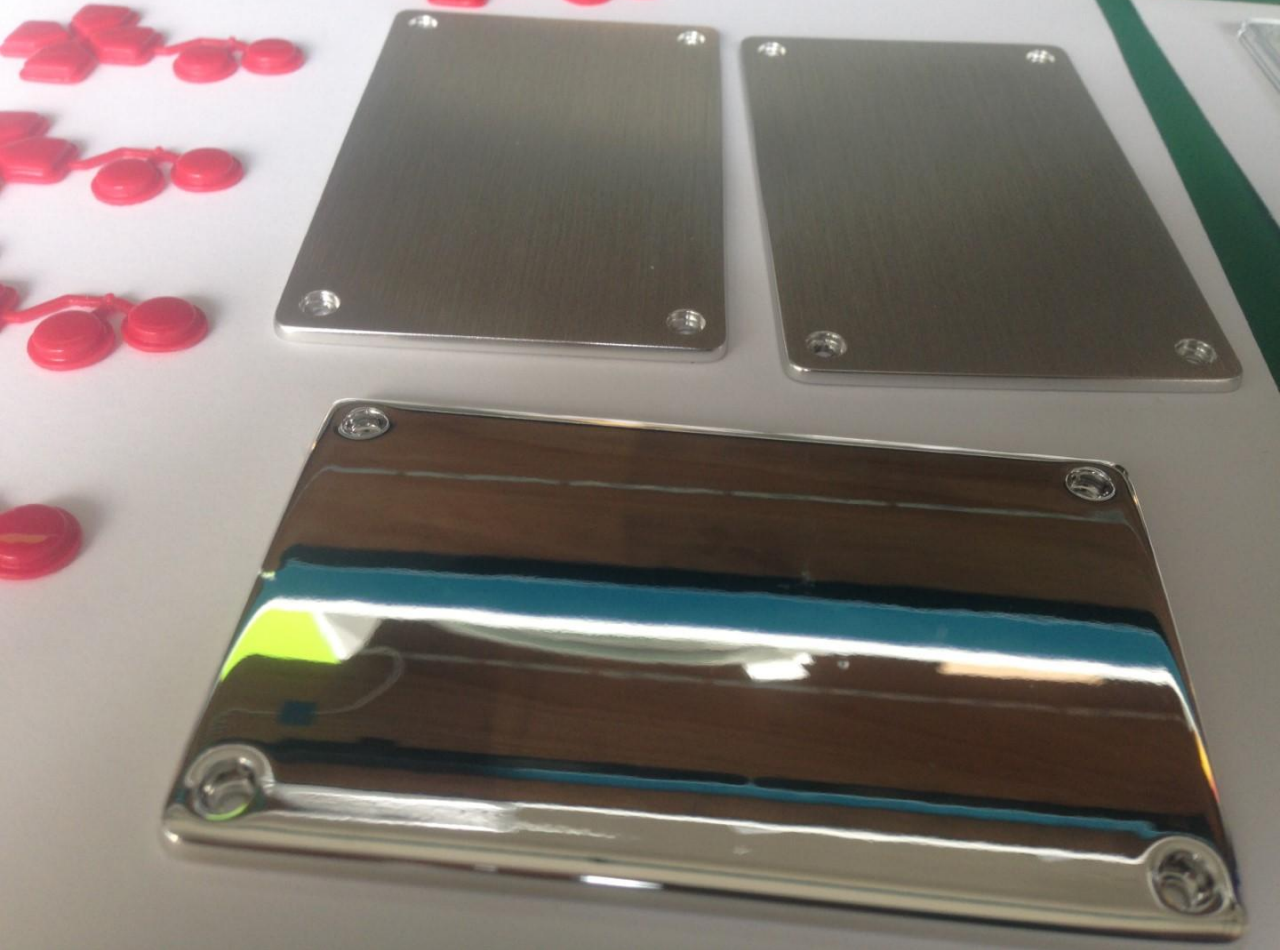
Programmable gaming on the go



Slim enough to fit in your wallet







CNC Samples

- 1 year from prototype to production
- 6mm thick from the original 1.8mm





Arduboy - Card Sized Gaming

Successfully funded

1732%
funded

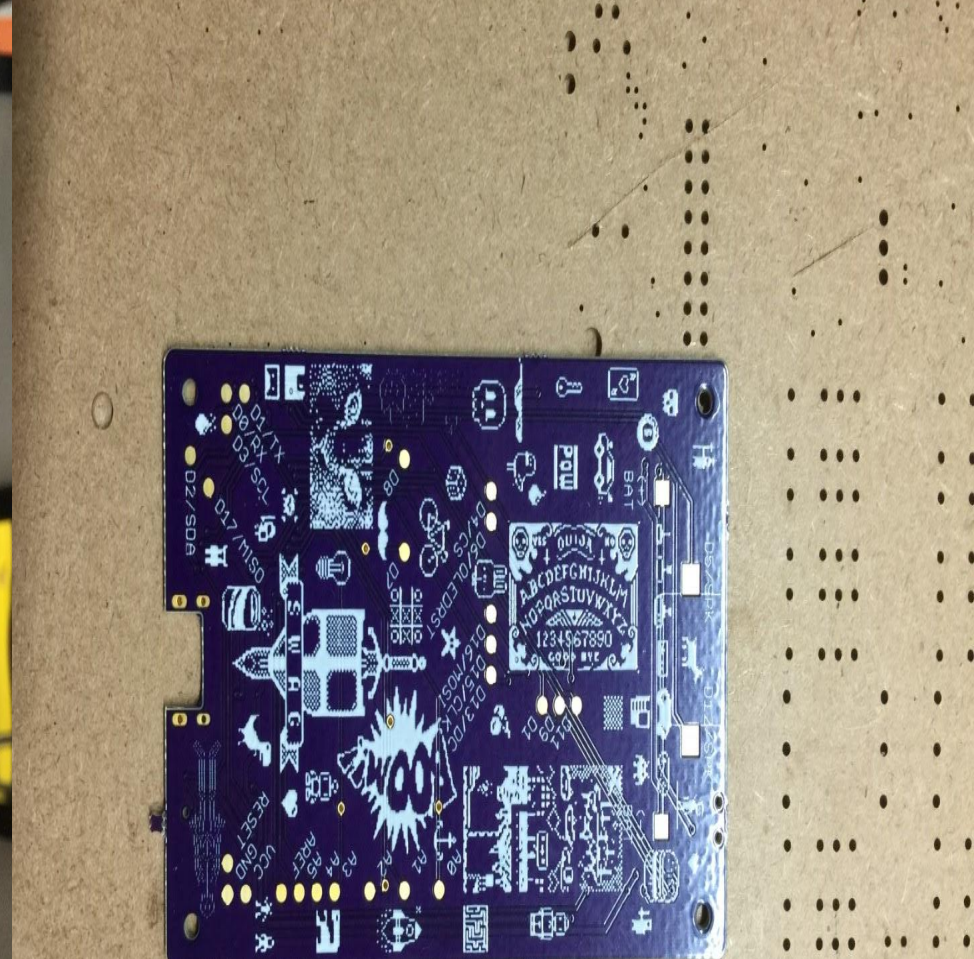
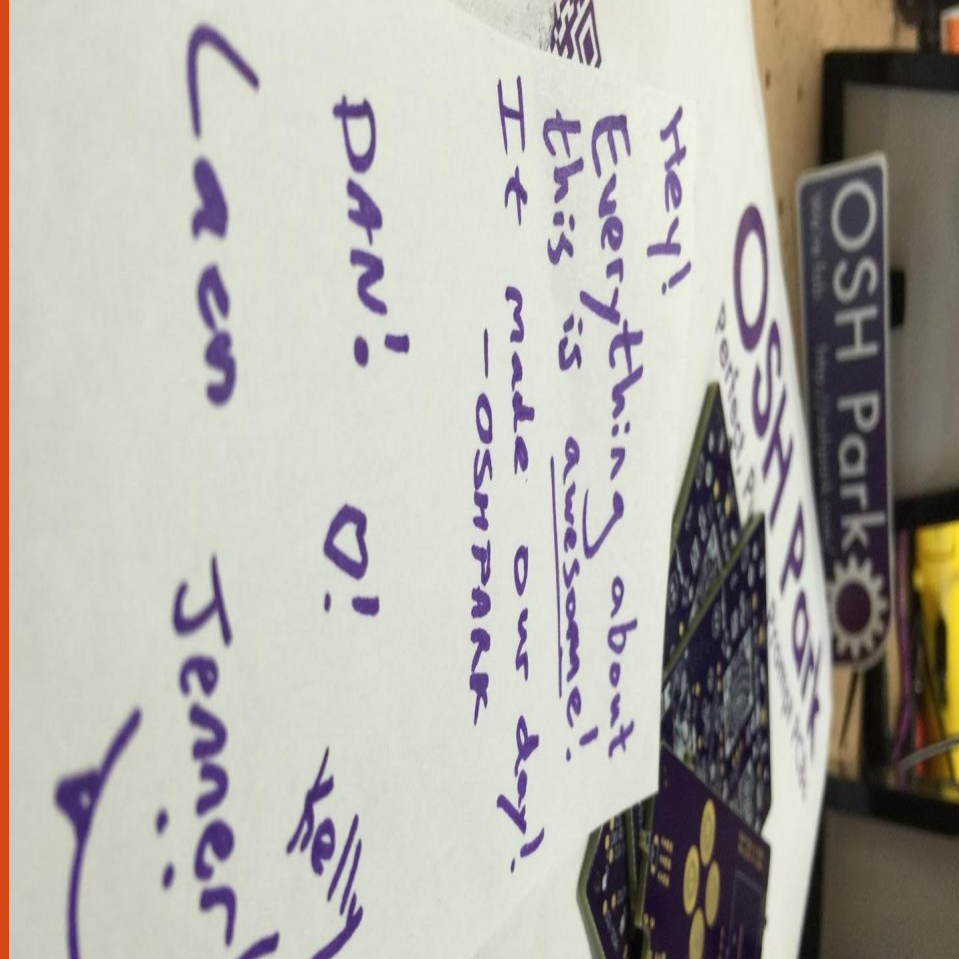
\$433,038
pledged

7,221
backers

Funded
Jun 10 2015

That's a lot of Arduboy's

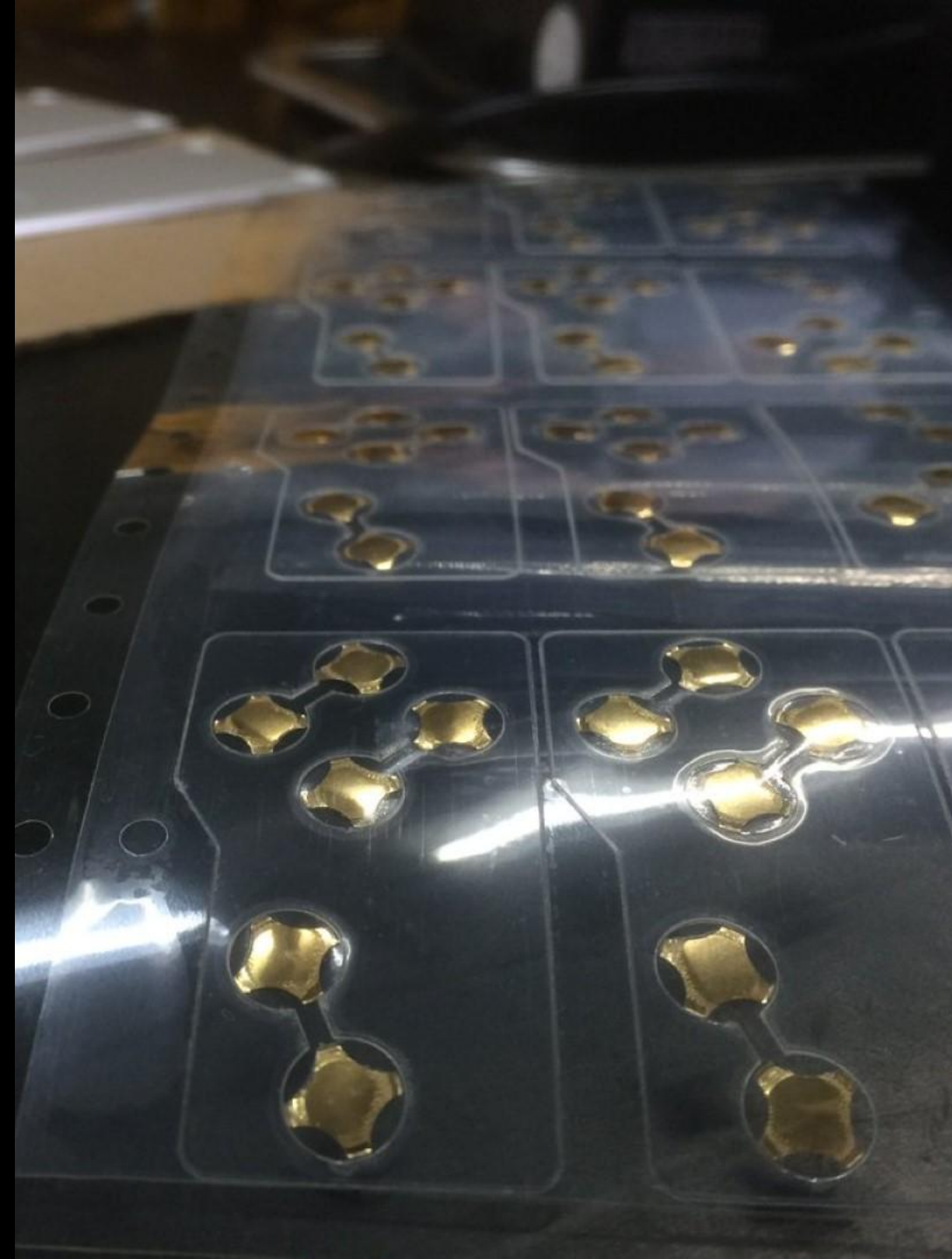
OSH Park

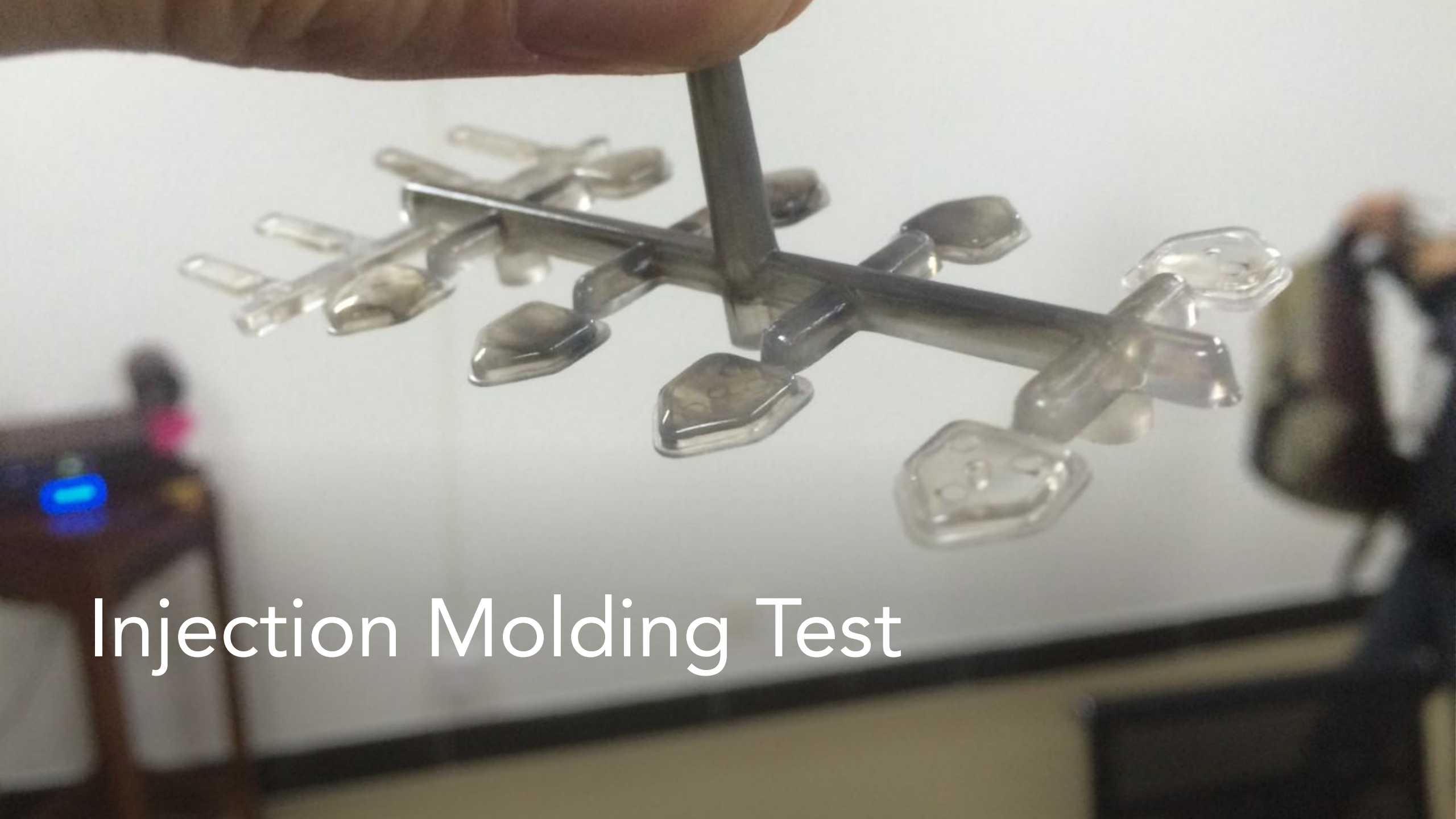


- Buy more purple PCBs!

Snap Dome Matrix

- Casually asked some market vendor something like this would cost
- In volume, is just a few cents each
- Cheaper than a single surface mount button



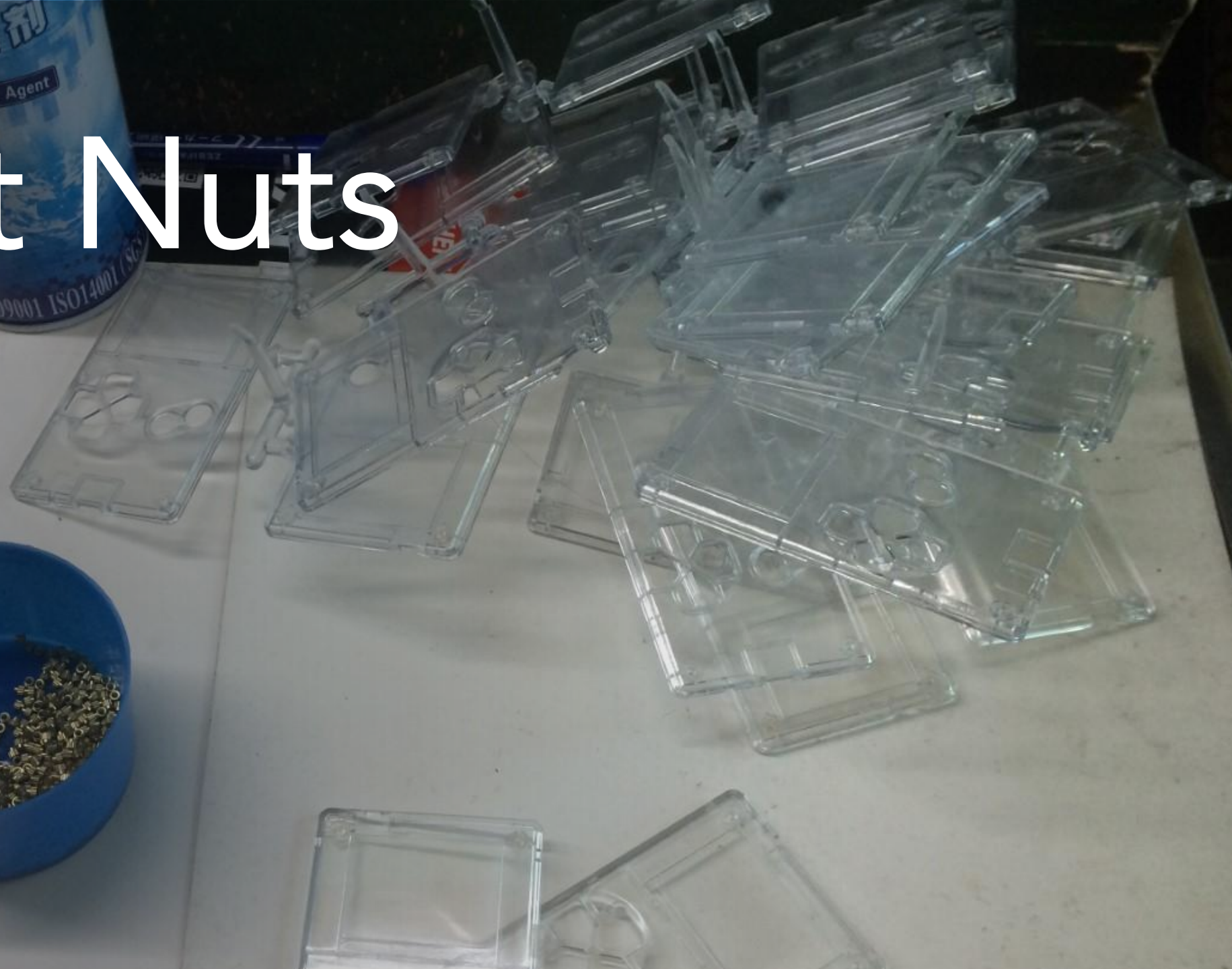


Injection Molding Test

Rejects



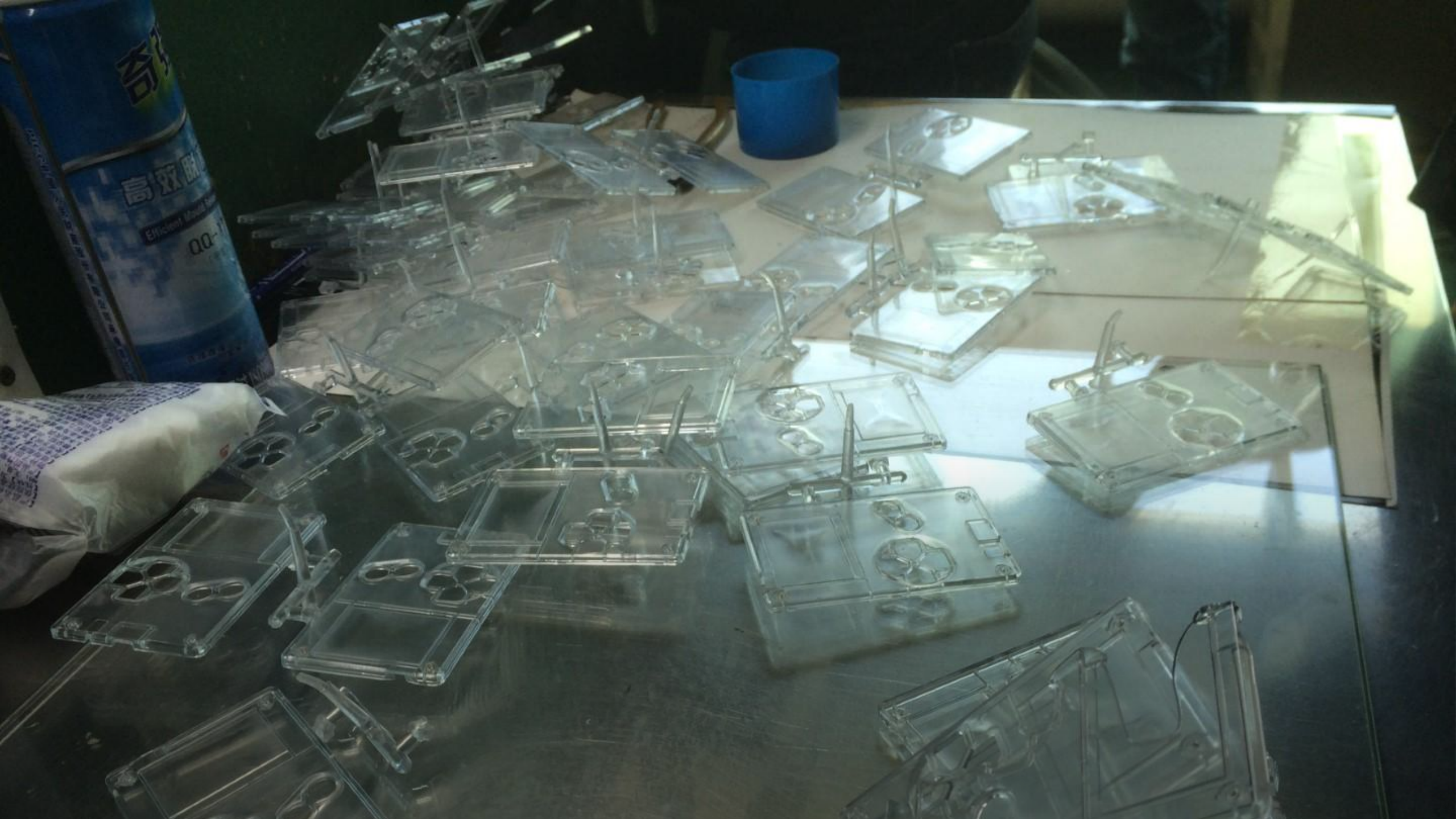
Insert Nuts



Manual Insertion

- Some unfortunate soul has to place all of these by hand
- Asked how many units would it be worthwhile to automate with a robot
- One million minimum





Production Samples

- Hand assembled from parts made from final tooling
- 1.5 years from going viral
- 6 months from going to China



Production Scaling



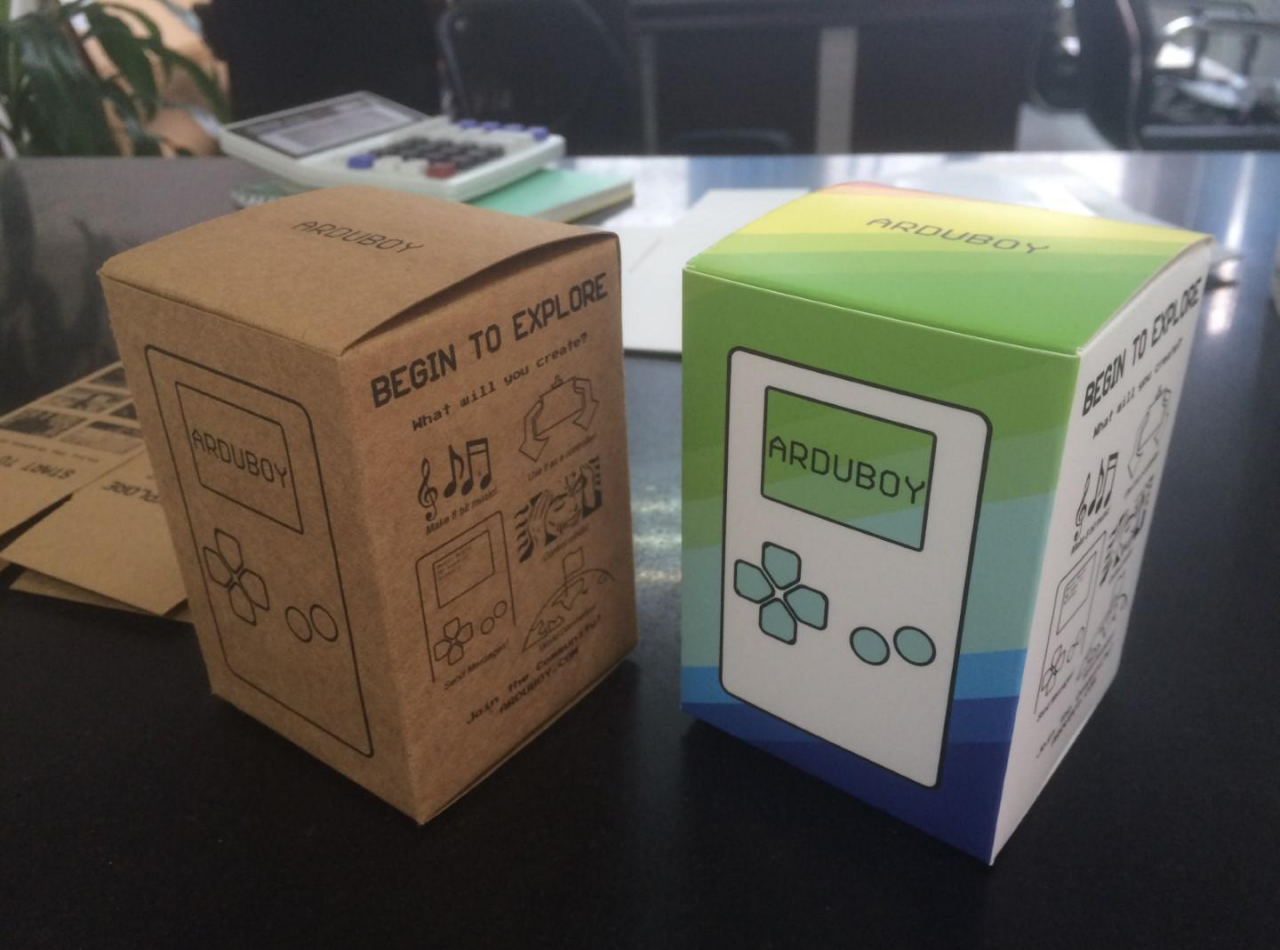
Celine Binder

- Production Manager
- Grew up in Singapore, spoke fluent Mandarin
- Without Celine, there would be no Arduboy





Quality Inspections



Packaging Ideas





ARDUBOY

Start to Play
开始玩吧
Empezar a Jugar
遊みましょう
Commencer à Jouer
시작하기
Начать играть



ARDUBOY

Start to Play

Learn
to
Code



Atmel

Start to
PLAY



VRKIX
Virtual Reality Classes
www.vrkix.com
We'll Show Your Mom



Join the community at
www.arduboy.com

Learn
to
Code

ARDUBOY

Make
&
Share
Games



It went well

Target Open House

- Demo event in a target store
- Evaluate customer interest
- Target was ready to buy 100,000 units
- Retail is scary



Retail Math

- Returns or theft is your loss not retailer
- Unsold inventory is potentially your loss (Target and Walmart)
- \$1,000 display x 1,800 stores = \$1.8 Million sunk cost
- Anything more than 7% returns would bankrupt company

Arduventure Kickstarter

- Return to existing customers and network
- Ambitious full featured RPG
- Grow organically
- Celebrate the community





Arduventure on Arduboy: 8-bit RPG for your wallet

Successfully funded

805%
funded

\$60,375
pledged

1,138
backers

Funded
Oct 14 2017

Exceeding Expectations

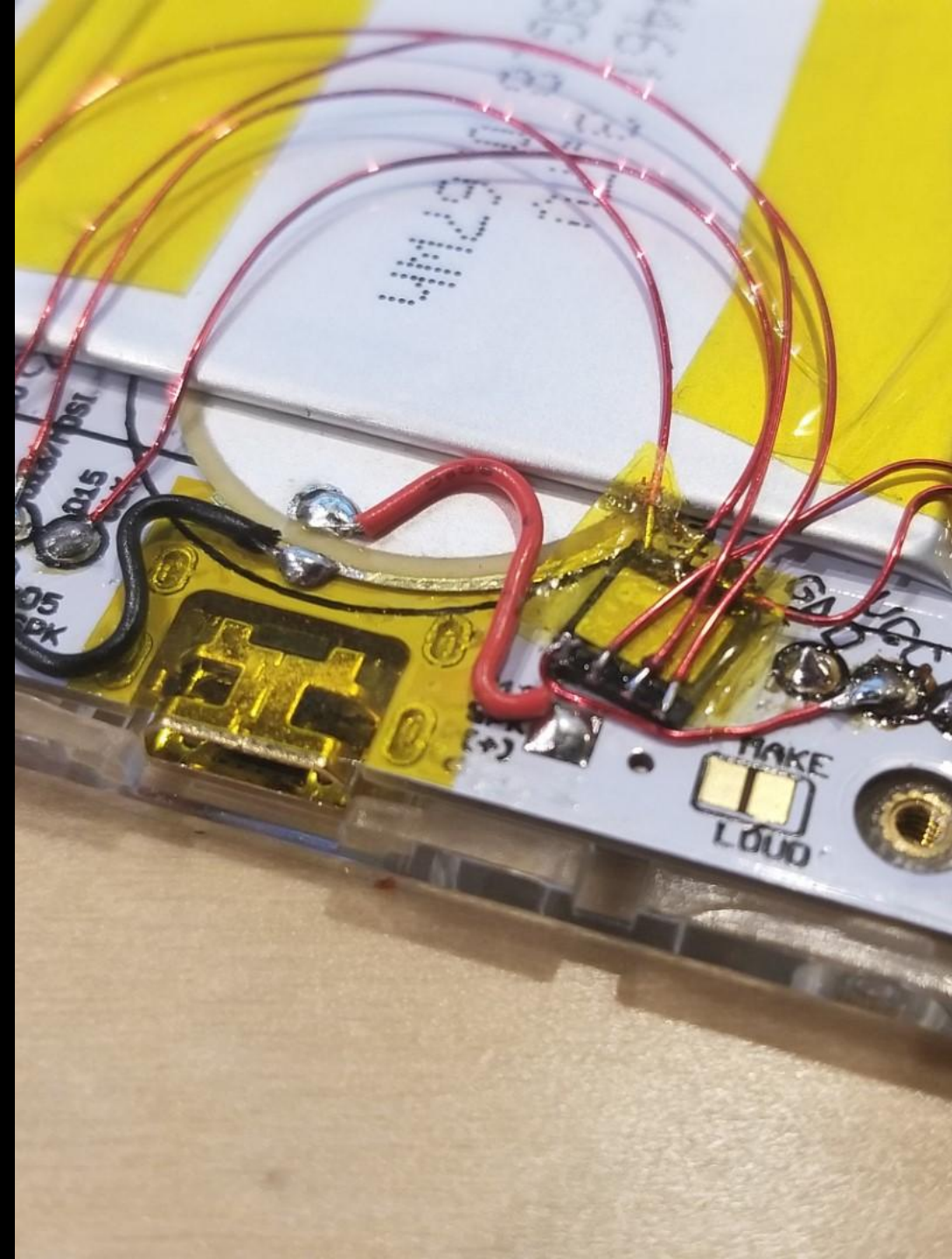
Mod Chip



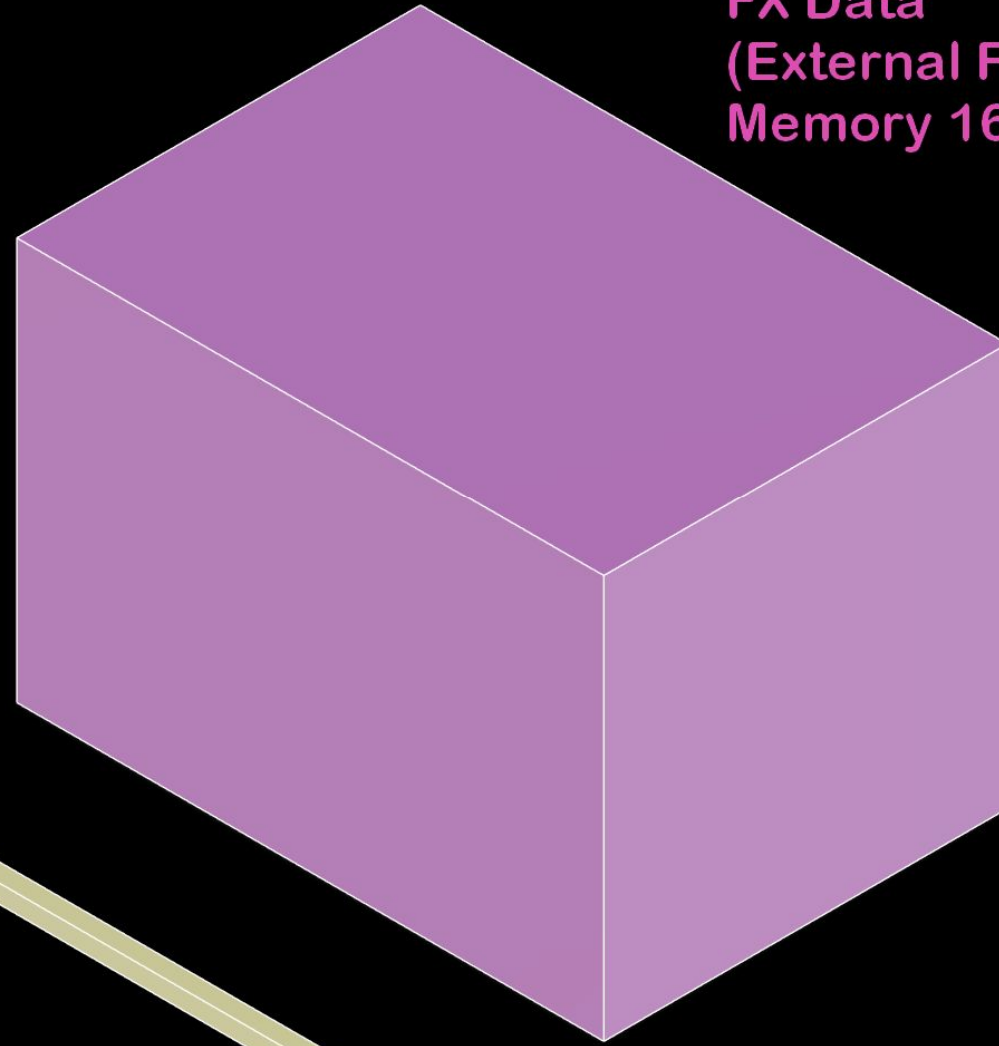
Thank you Mr.Blinky

Just add flash

- Created by community user Mr. Blinky
- Uses a custom bootloader to access games on external memory
- Written entirely in assembly



FX Data
(External Flash
Memory 16MB)



Game Data
(Internal Flash 24KB)



Bootloader
(Internal Flash 4KB)



ARDUBOY FLASH MOD ALPHA 0.01A

DRM828 Experimental Design
Utilizing 10W power of 2.0-4.2 VOLTS

UART
OUT
slave
IN
ack
sock

U2/SUH

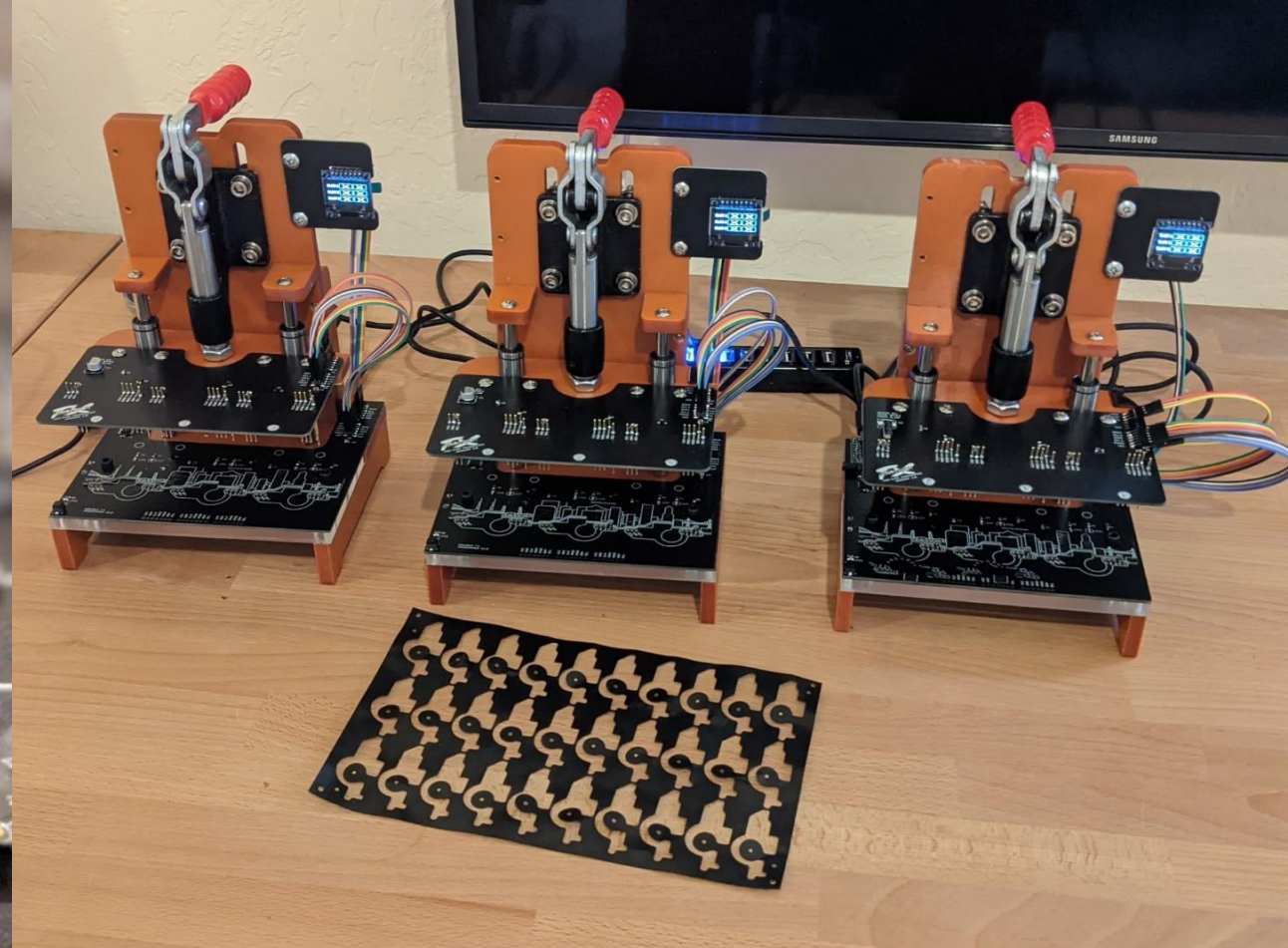
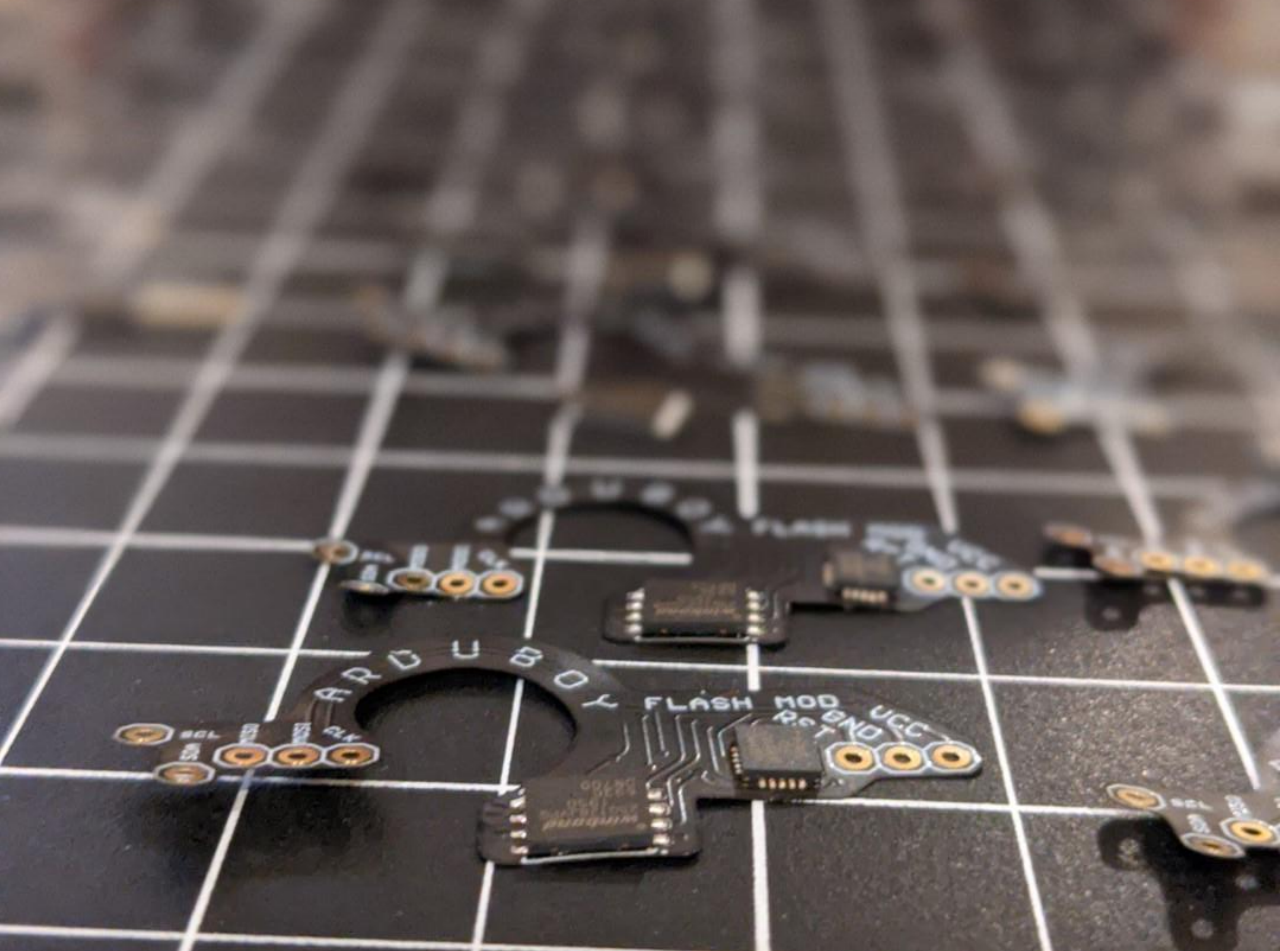
05
SPK
[-]

D13
SPK
[+]

LINK

LOUD

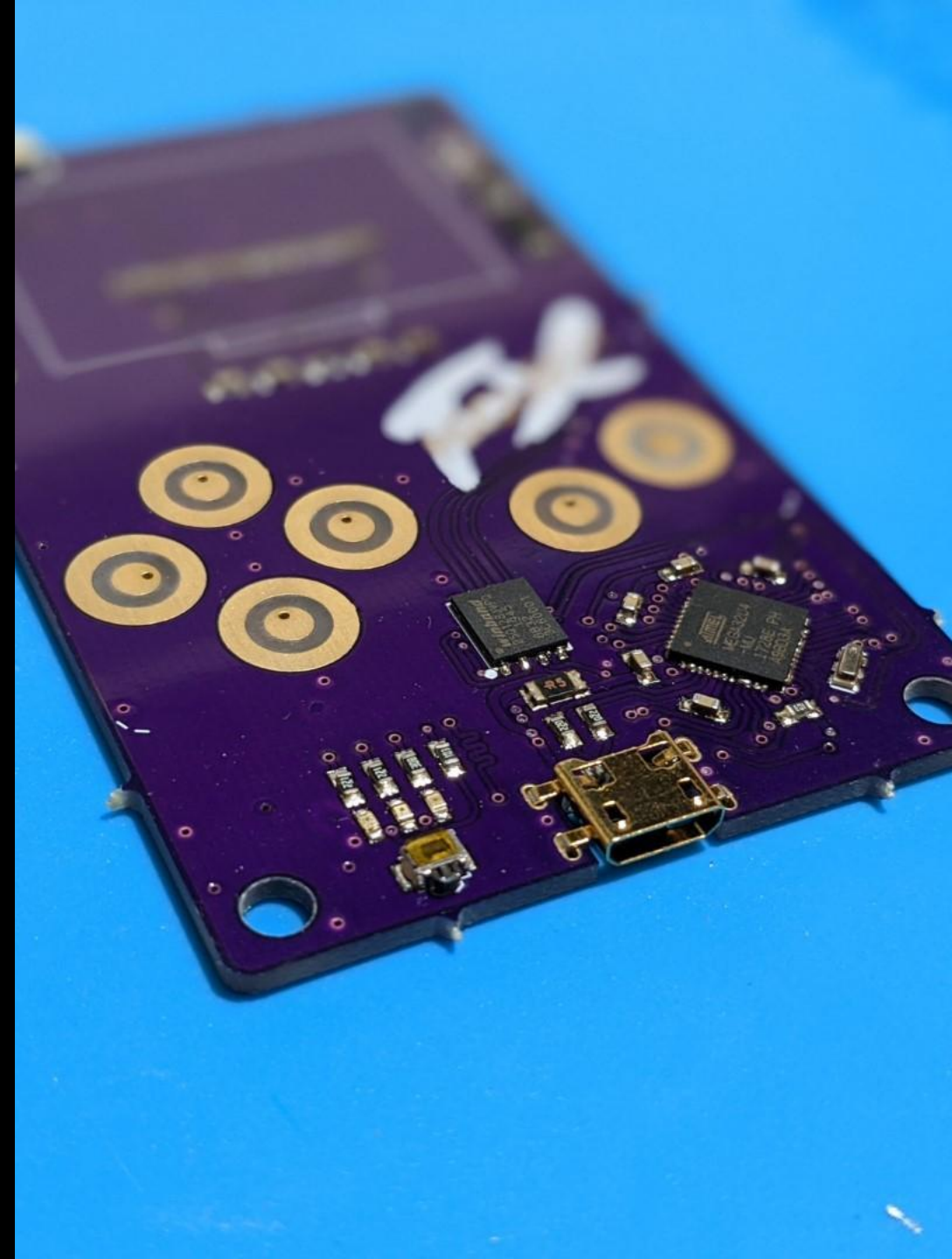
REAL
POWER



Programming Mod Chips

Born of Success

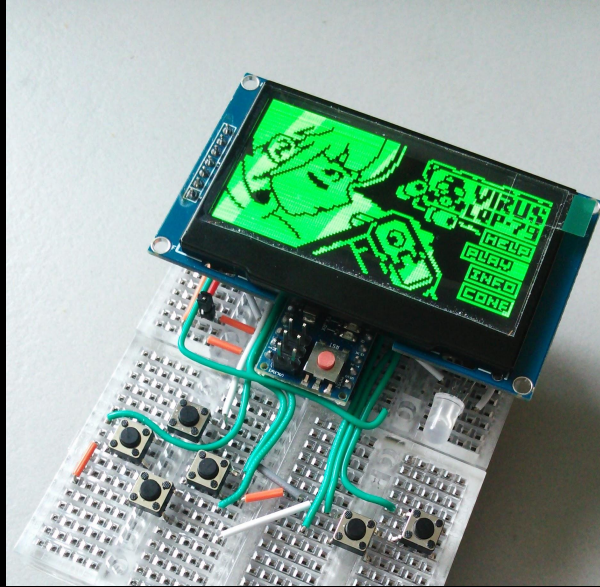
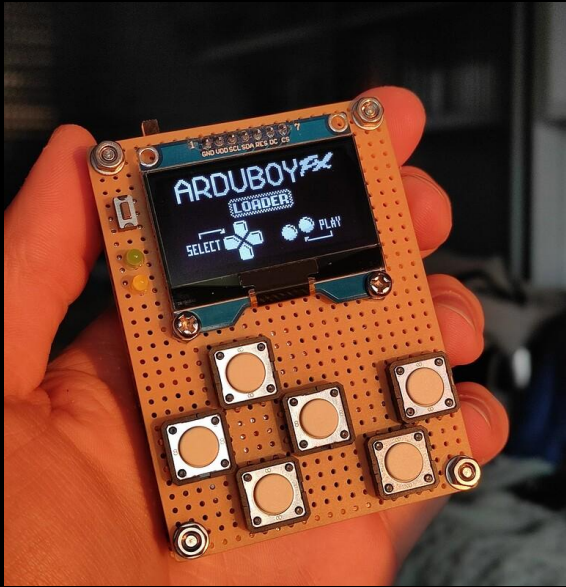
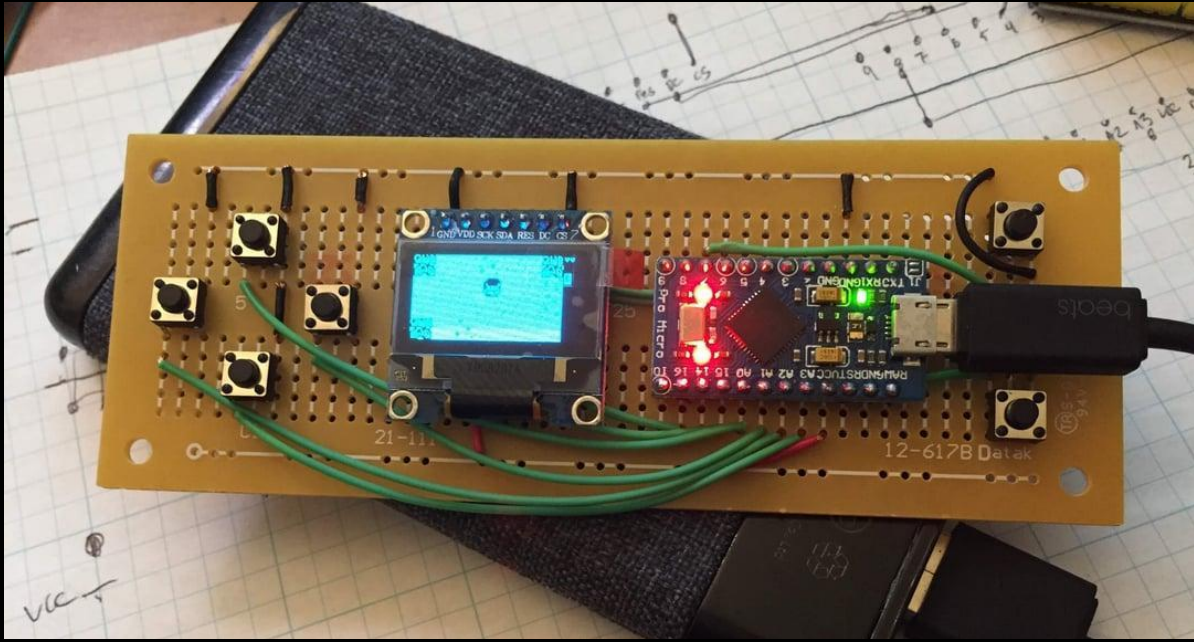
- Arduboy declared dead during the pandemic due to the chip shortage
- Sold existing inventory “pre-modified”
- Enough pre-orders to restart production
- Arduino supplied the chips

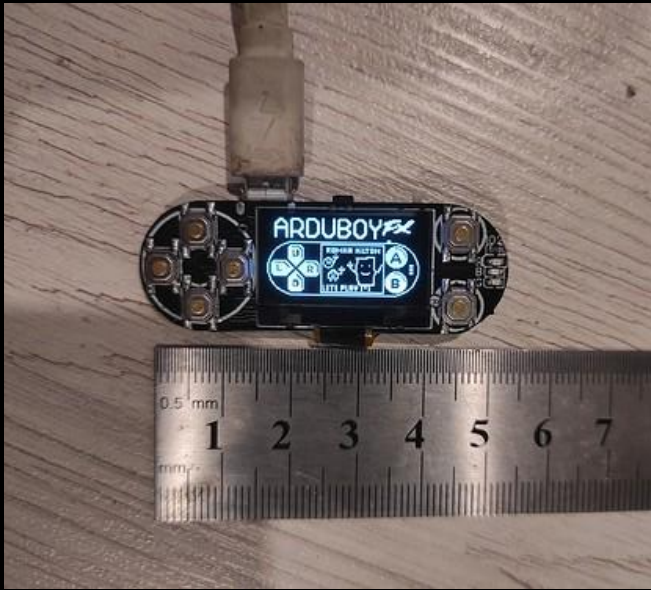
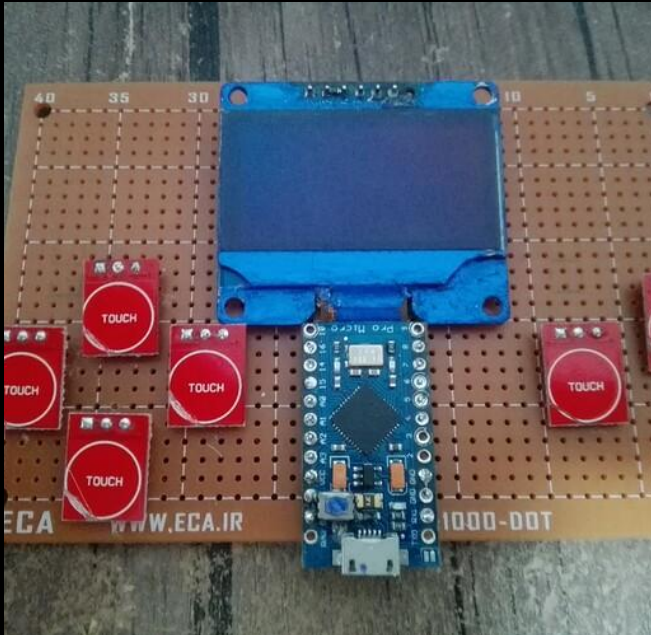


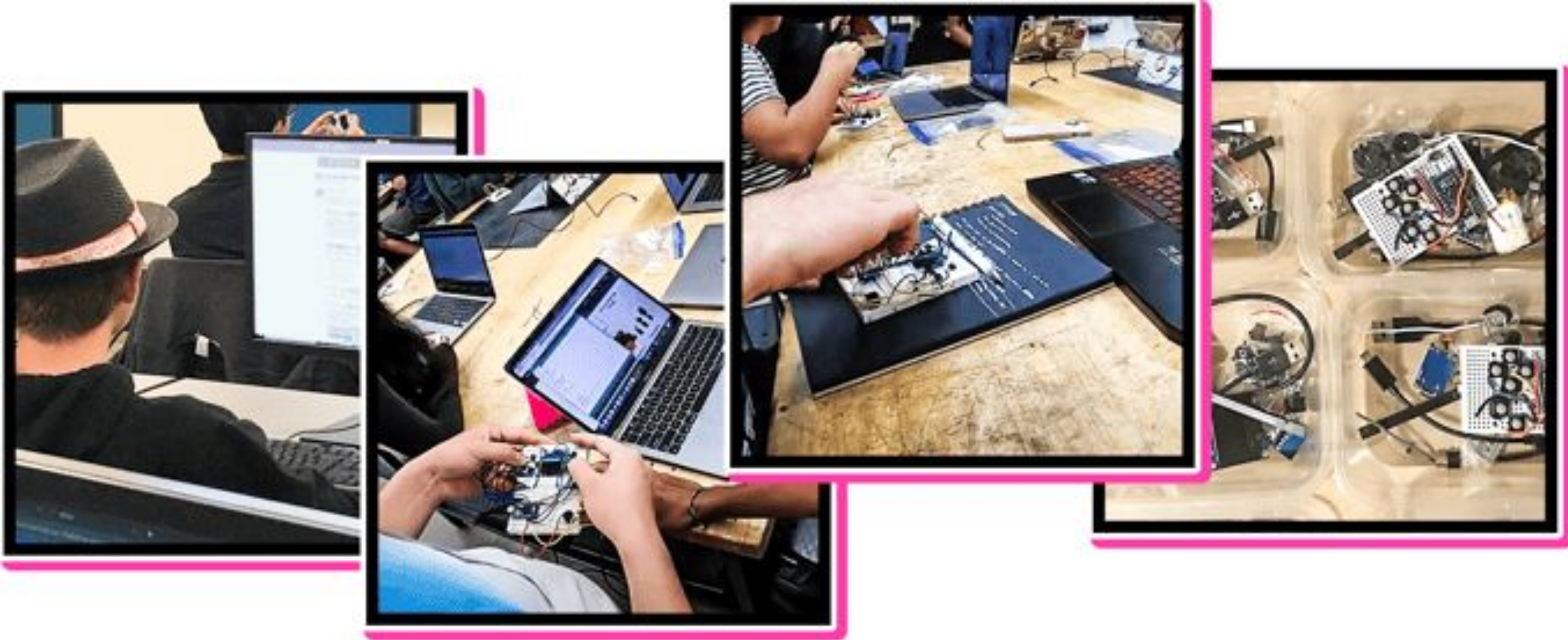
Arduboy FX

On board mod-chip









Education

- Arduboy is used in schools around the world
- Teachers self-funding, self-writing curriculum

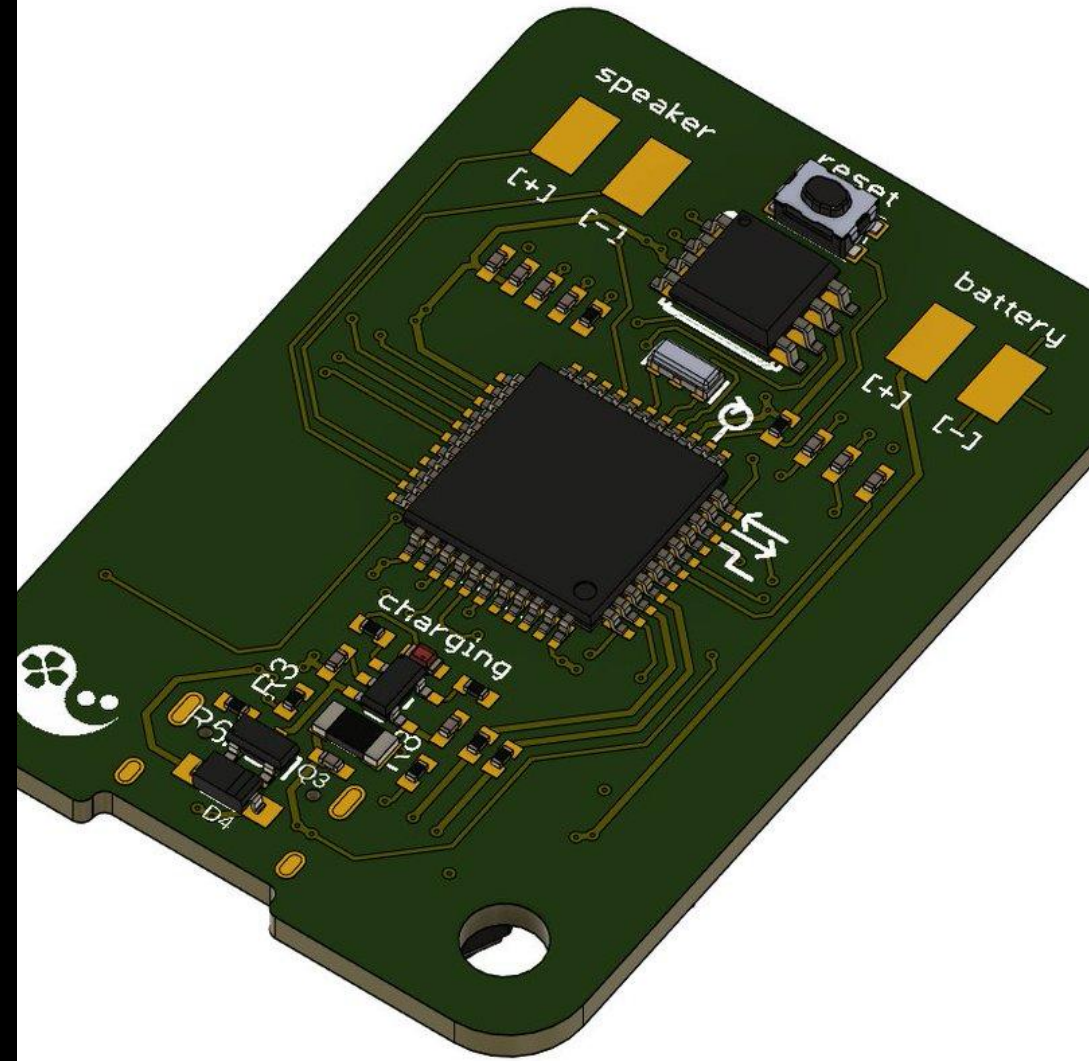
First Prototype 2019

- Just for fun
- Community was making a lot of DIY
- This was my version
- Mothballed due to pandemic/chip shortage



3 years later...

- Project is revived by community member Acedent
- Added USB-C
- PCBWay contacted me about a potential sponsorship



Sponsored by PCBWay

- Perfect timing
- Made it possible to offer many options, more than just pcbs! (3d printing)
- Easy to work with, provides great feedback, catches my mistakes
- Great quality and speed

Arduboy Mini





ArduBoy Mini

Successfully funded

663%
funded

\$66,316
pledged

1,057
backers

Funded
Jan 4 2023

Continued Success



Celebrating Developers

Arduboy is the Community

I just glued an OLED to an Arduino

Community Thanks

- Pharap - moderator and coding support
- MLXXXP - moderator, library and documentation manager, hardware design support
- Dreamer3 - original library contributions
- Crait - moderator, game developer and friend
- Filmote - game developer, cart manager and friend
- Fmanga - created the original online emulator
- Eried - created the first repository and upload tool

Community Thanks

- Brow1067 - created new simulator, ABC scripting language
 - Simulator has full stack step through debugging
 - ABC language is feature complete language, the interpreter runs on the 32u4 and the program script is stored on external memory. In practice allowing executable code space as large as external memory.
- Haloopdy - created Arduboy Toolset, cross platform gui for all of Mr.Blinky's python tools
- Acedent – one of the earliest community members, helps in small but important ways, like with this presentation

Conclusion

Final thoughts

What made Arduboy successful?

- A single object with an obvious self-descriptive design.
- Give the users as much power to create and modify as you have.
- Provide a structured space for users to communicate, and share.

Why Arduboy?

- Self directed game development teaches valuable life skills
- Critical thinking, attention to detail
- Problem solving, creativity
- Setting goals, self motivation
- Communication, collaboration

Arduboy Inc has never made profit

- Grows almost 200% every year
- Losing money very slowly, rollercoaster ride of pre-orders and out of stock
- No reoccurring revenue streams, no monetization of content
- Game consoles are famously loss leaders to the revenue of their games

Money is important

- But it doesn't have to come first
- If you do things right, you don't have to prioritize it
- Produce good work, the money should come

What is an open-source economy?

- A balance between capitalism and socialism
- How do we fund things that make the world a better place?
- Shift in the "maker movement", people are realizing there is a much larger gap to go to market.
- Adafruit, Pimoroni, Spakrfun, becoming a large company is the only way to survive

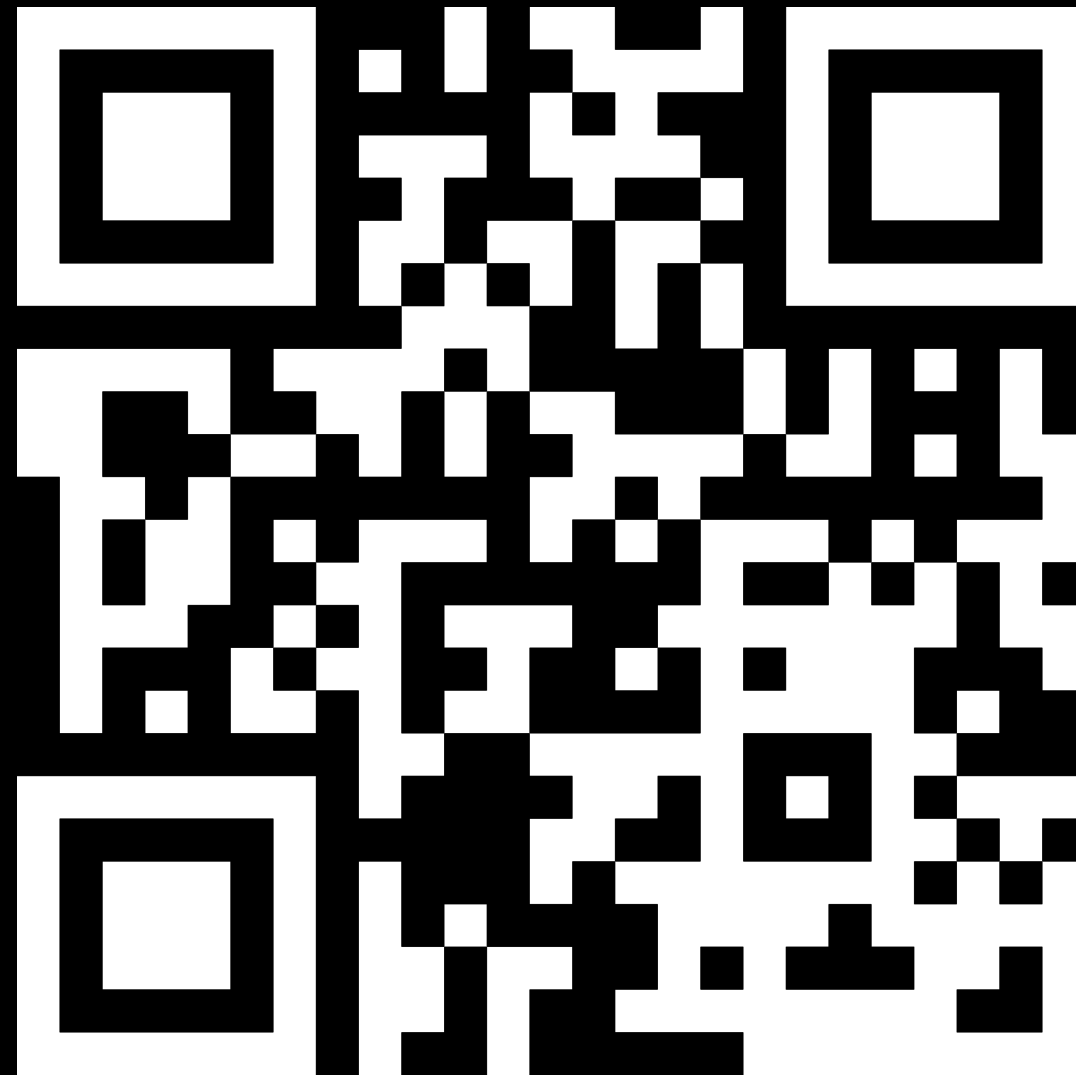
Final Thoughts

- Social accounting, the success of Arduboy cannot only be counted in dollars
- What cost is worth enriching the world?
- Performance art in the medium of a corporation
- The purpose of Arduboy, established with that first investor phone call.
- 10 years later the vision has been fulfilled many times over, where will we go next?

PCBWay

Thank you!

Arduboy.com



<https://Singleboard.Computer>



- A new device for a new platform
- Arduboy community without the Arduboy
- Testing the same concept, agnostic of a single hardware
- Share your Singleboard today!