Solar Powered Heart Blinky LED Pendant Jewelry

by **lumenjewelry** on May 16, 2013

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We're life-long tinkerers, siblings, and fourth generation engineers. We're not quite sure which of us had the idea of putting LED's on jewelry and powering them with solar cells, but once Marty proved it could be done there was no stopping us. That idea became Lumen Electronic Jewelry. Marty is now the Chief Geek, Robin is the Design Diva.

Intro: Solar Powered Heart Blinky LED Pendant Jewelry

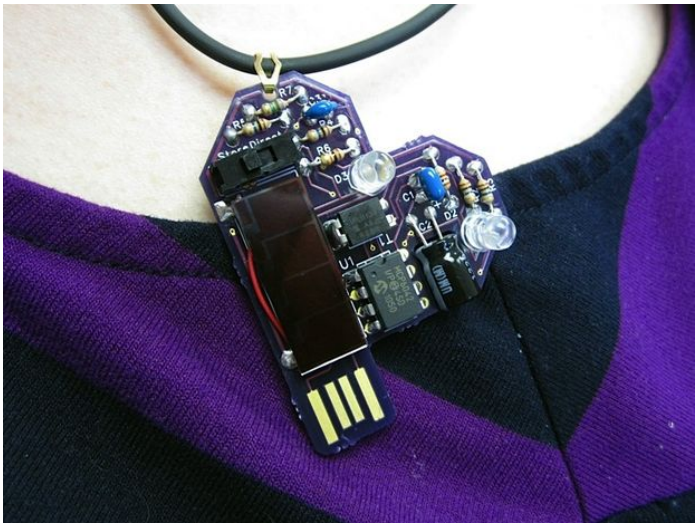
This instructable is for solar powered heart with a pulsing red LED. It measures about 2" by 1.25", including the USB tab. It has one hole through the top of the board, making hanging easy. Wear it as a necklace, earrings, bond on a pin, or hang it in a window. The possibilities are up to you, and we'd love to see what you do with them.

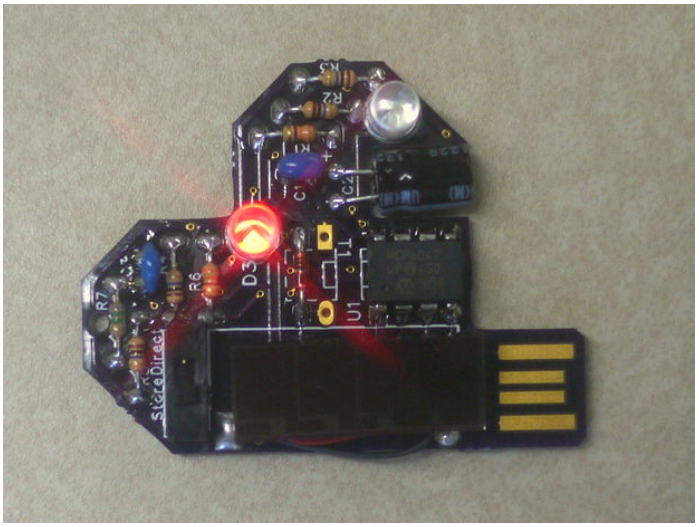
The schematic and parts list are included. You are welcome to wire up your own, copying is the sincerest form of flattery. We also have the kit available in our Etsy Store .

If you have soldered projects before, this will be easy. There are only 16 pieces to solder onto the board, and all but one is through hole. Depending on your soldering savvy it may take anywhere from 30 to 45 min.

So lets begin!

Heart Kit02.mp4 from Robin Lawson on Vimeo.





Step 1: Tools

Here's what you need:

A soldering iron
Solder
Diagonal cutters
Needle nose pliers or tweezers

Helping hands are optional, but helpful.

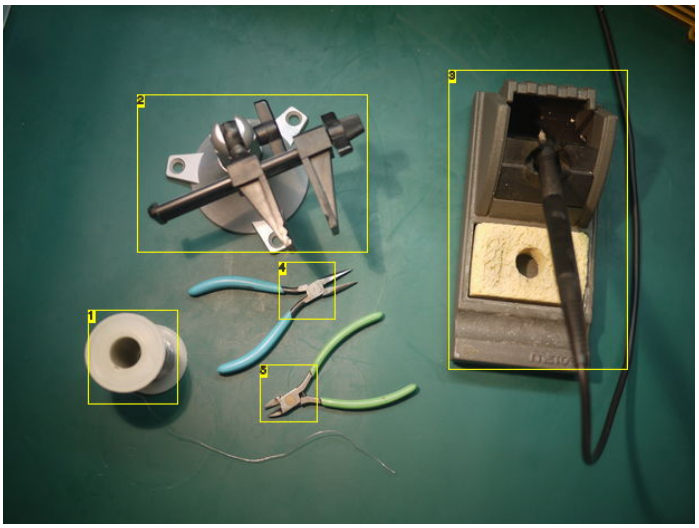


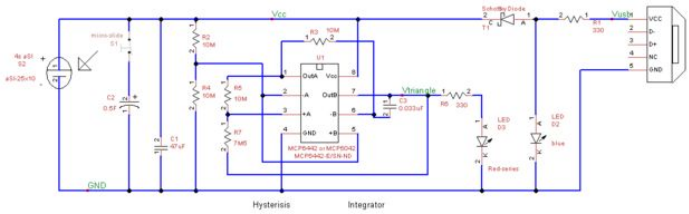
Image Notes
1. Solder
2. Helping Hands
3. Soldering Iron
4. Needle nose pliers
5. Diagonal cutters

Step 2: Schematic and Parts list

Schematic is above.

Parts list is below.

C1 - 47uF ceramic capacitor (medium blue one)
C3 -0.033uF Timing capacitor (little blue one)
U1 - MCP6042 dual micro-amp op-amp
R7 - 7.5M resistor
R1 and R6 - 330ohm resistor
R2 through R5 – 10M resistor
T1 - 30v schottky
S2 - 4s aSI 25x10 solar array
C2 - can super cap
D2 - Blue LED, charge indicator
D3 - Red LED, Blinky
Switch - SPDT switch 3-pin 0.1 spaced



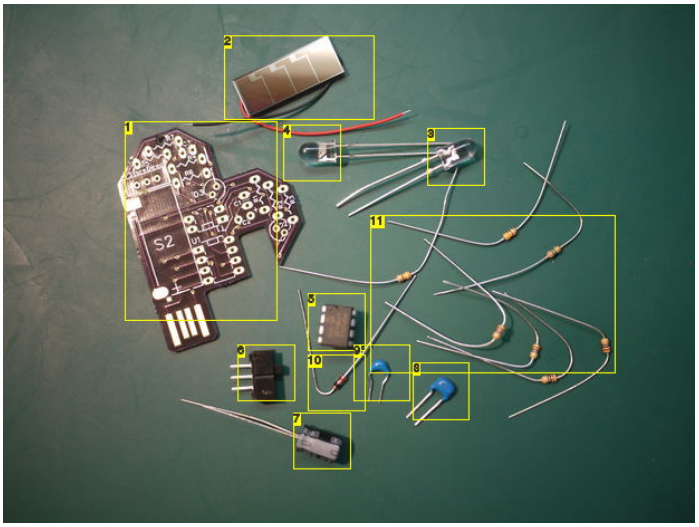


Image Notes
1. circuit board
2. solar cell
3. Blue LED
4. Red LED
5. Chip
6. Switch
7. Super Capacitor
8. C1
9. C3
10. T1 - Diode

Step 3: Capacitors

Start with the two small blue caps. You may need to bend the leads to make them fit. They may all look similar, but it is important that the correct one go in the correct slot. BTW, they don't have a polarity, so once you figure out which is which you can't get it backwards. Below is a short description of how to read the numbers on them, but for more detail check out this cool electronics wiki .

C1 is the medium one. The tiny numbers on it read "476". The first two digits are the value, the third is the multiplier. Capacitors are measured in pico-Farads. So 476 is 47*10^6 pico-farads.

C3 is TINY and has 333 written on the side.

Solder on the top side as shown.

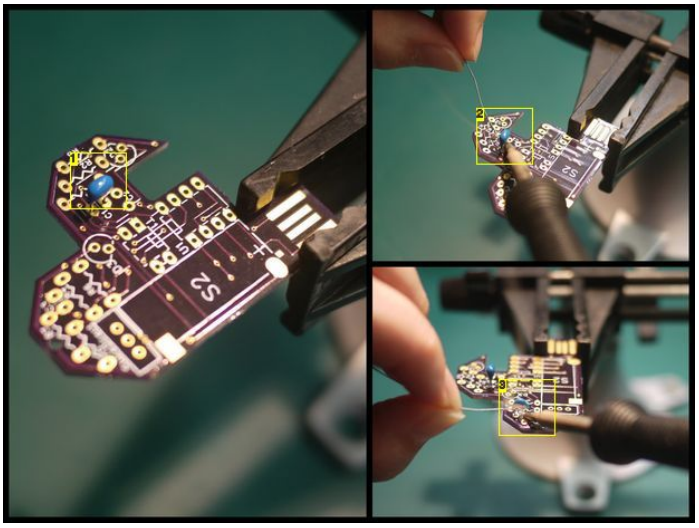


Image Notes
1. C1
2. Solder on C1
3. Solder on C3

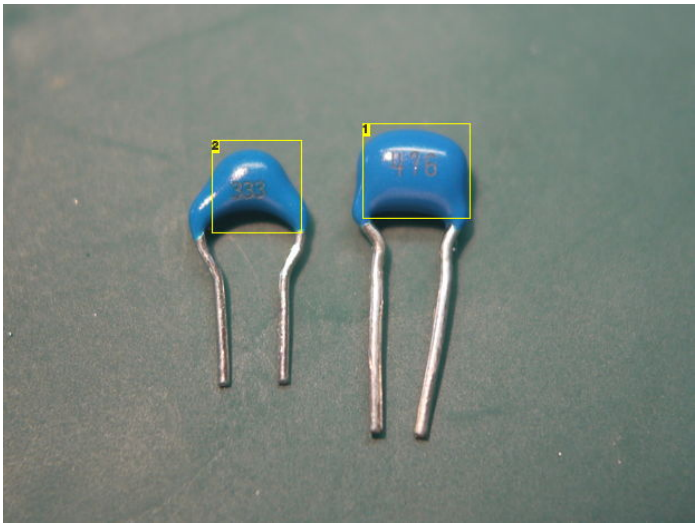


Image Notes
1. C1
2. C3

Step 4: Chip and Diode

Next the chip. Be very careful of stray electric shocks, they may fry the chip. We know this from experience, ouch. Ground yourself before handling the chip by touching a large metal object first. We find the bolts on outlets are usually grounded, and often nearby.

Line up the chip on the board, U1. The cutout on the chip should match the square on top of the board chip footprint. You can see it in the picture. You may have to squeeze the leads on each side to get it to snap in.

You can also add the schottky diode. Don't ask me how to pronounce that, I think its German. It is the glass orange tube with the black stripe. It goes between between pins 2 and 3 of T1 footprint, or the top two as shown. The bottom two pins on T1 are empty. The orientation of this matters, the black bar faces the solar cell as shown (pin 3).

Solder everything on top as usual.

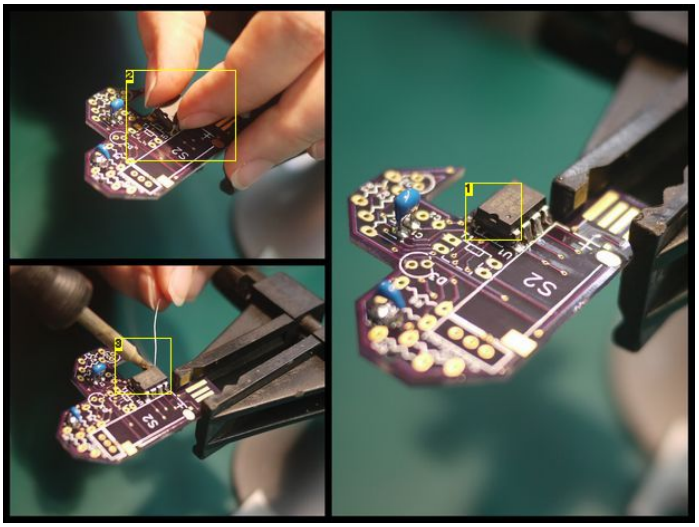


Image Notes
1. cutout on top of chip

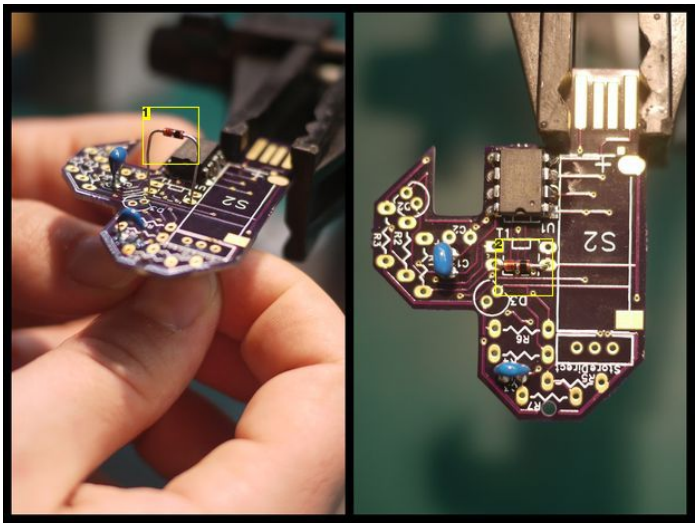


Image Notes
1. Schottky diode

2. Squeeze leads to fit
3. Solder on top

2. Black stripe towards S1 Solar cell

Step 5: Resistors

Next the resistors. Bend the leads so they fit, and pull them through the board so they are nice and tight.

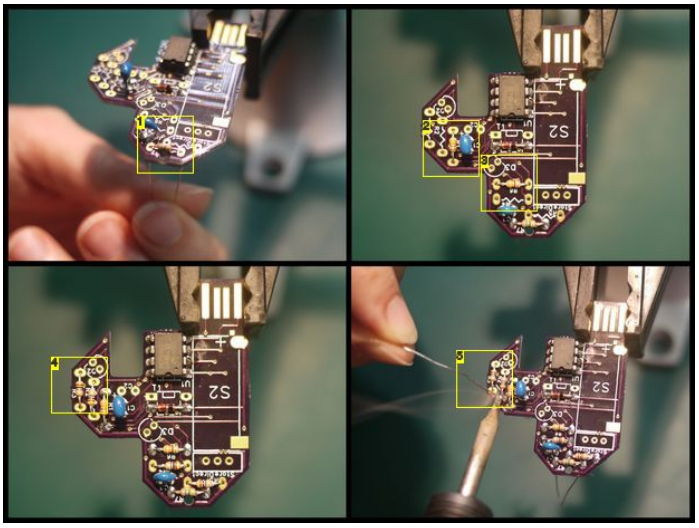
We recommend starting with with R7, its the green odd one out. Check out this handy dandy link for how to read resistors . Unfortunately, they are tough for color blind people to decipher. But, I hear there is an Ap for that. ;)

Next move on to R1 and R6, the orange striped ones.

The remaining 4 resistors are all the same, brown black. Pull them through as well.

Solder them on from the top.

We recommend flipping it over and trimming the leads at this point.



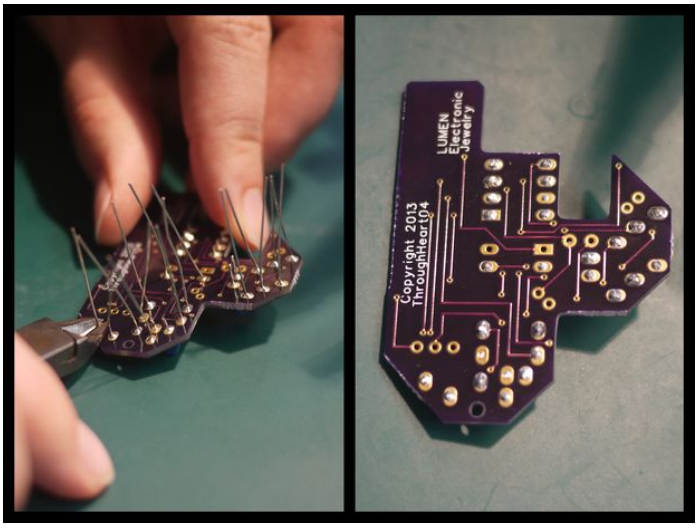


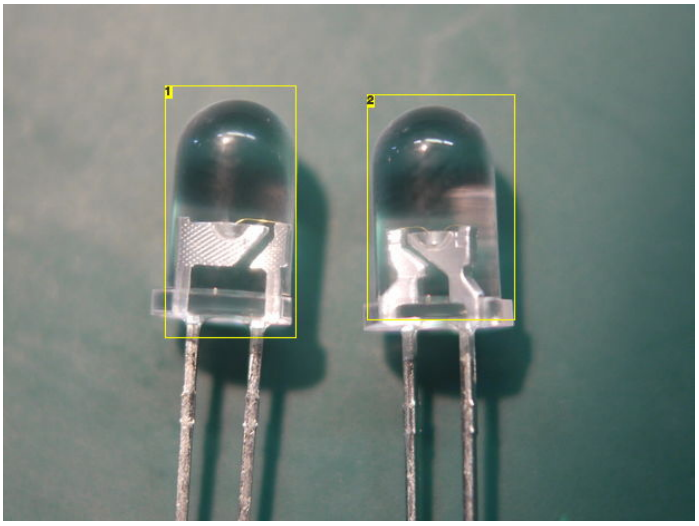
Image Notes
1. R7
2. R1
3. R6
4. R2 and R3
5. Solder on top

Step 6: LED! Blinky!

Now for the fun part, the blinky bits! D2 and D3 are the blinky LED. D3 is red and D2 is blue, and at it is important to figure out which is which. At first they may look the same, but on closer inspection you can see their filaments are different. The red one has flat sides to the filament, the blue one has notched sides to the filament.

It is also important that they be soldered in correctly. But luckily it is much easier to tell the polarity. The circle around their holes has a flat side. Line that up with the flat on the LED and you have the polarity correct.

We recommend soldering while upside down, as the LED covers the pads on the top. Flip it over and solder them on.



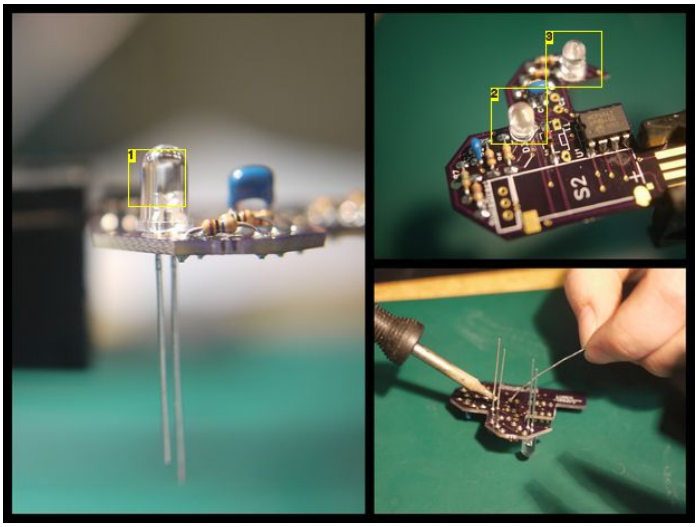


Image Notes
1. Red LED D3. Straight sides

Image Notes
1. D2

2. Blue LED D2, notch in sides

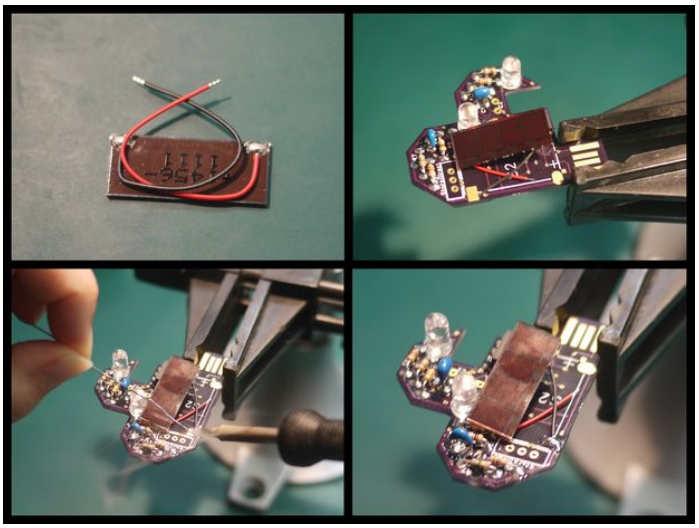
2. D3
3. D2

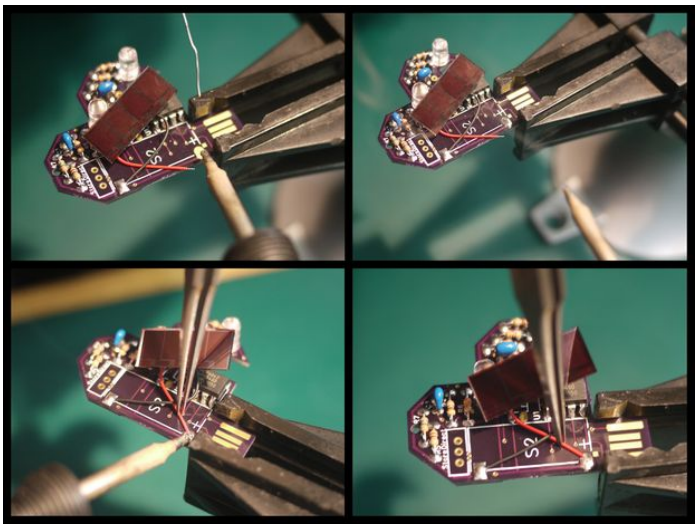
Step 7: Solar cell.

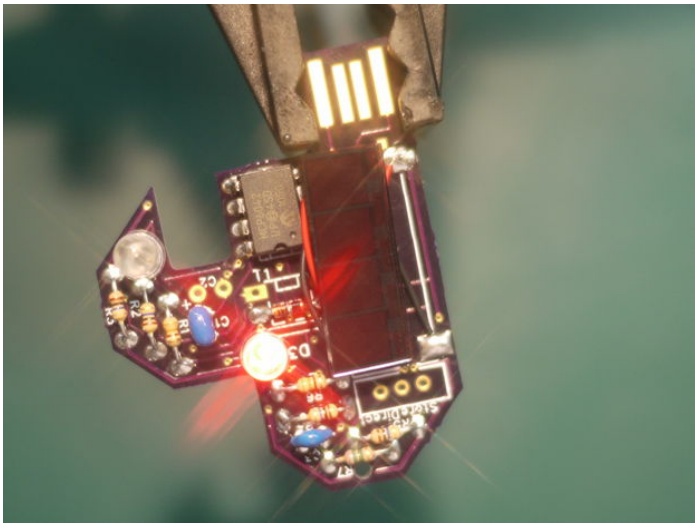
Next the solar cell. It really REALLY matters that this is put in correctly, however it is easy to tell. The red lead is the positive, the black is the negative. We recommend coiling up the leads under the cell now, so they tuck away nicely once you hot glue it down. Add solder to one of the pads, then melt the solder while holding the lead in the solder. Wait for the solder to cool before letting go of the tweezers. Repeat this process for the other pad.

What is the best part about this step? If you are in a bright naturally lit room, and soldered it all correctly, IT WILL NOW BLINK! Check out the video, neato huh? The LED's are running directly off the ambient light collected by the solar cell. Or for even more power, stick the USB tab into any available socket and they'll REALLY shine. WINNING!

Heart kit 01.mp4 from Robin Lawson on Vimeo.







Step 8: Switch and Storage

Next solder on the switch. It doesn't matter which way you put it in. As before, we recommend flipping it over and soldering from the back side.

One warning, the switch is made of low temperature plastic, so it will easily melt if the soldering iron touches it. By this time you should be a pro at soldering so I wouldn't worry too much about overheating the pins and melting the switch.

And finally, the SUPER CAPACITOR! This puppy will keep your cute little blinky heart going for several hours after dark. The negative lead is labeled on the body of the cap by a -sign on the grey band. The positive lead is labeled on the board. Another way to tell which lead is which, the positive lead is the longer one. Stick the cap part way through the board and bend it into the slot as shown. You can solder this one on the top, then one final trim.

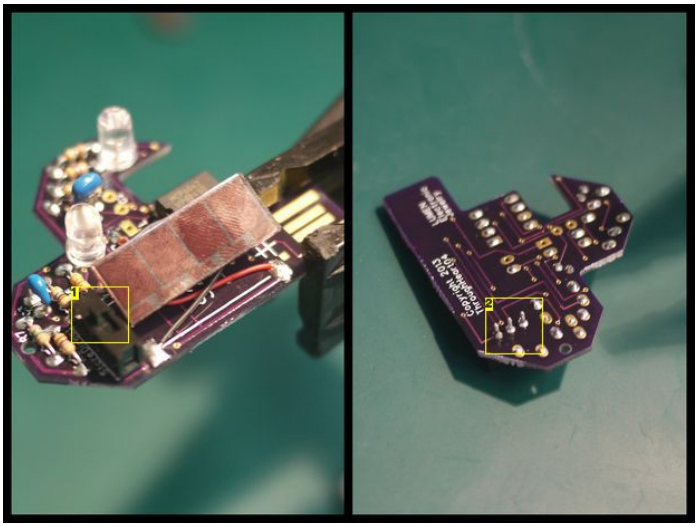


Image Notes
1. Switch
2. Solder on back side

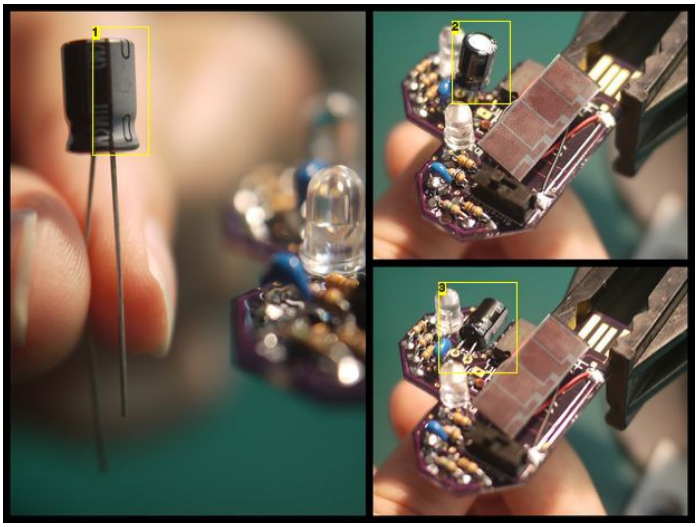


Image Notes
1. negative lead
2. Stick cap part way in
3. Bend cap over into slot.

Step 9: Hot gluing on the solar cell

And the final step is to hot glue on the solar cell. If they aren't already, coil the wires under the cell neatly. Lift it up, and apply a dab of hot glue to the board. Press the cell down into the hot glue. Allow it to cool and trim off the excess glue if necessary.

YOU'RE DONE!!!

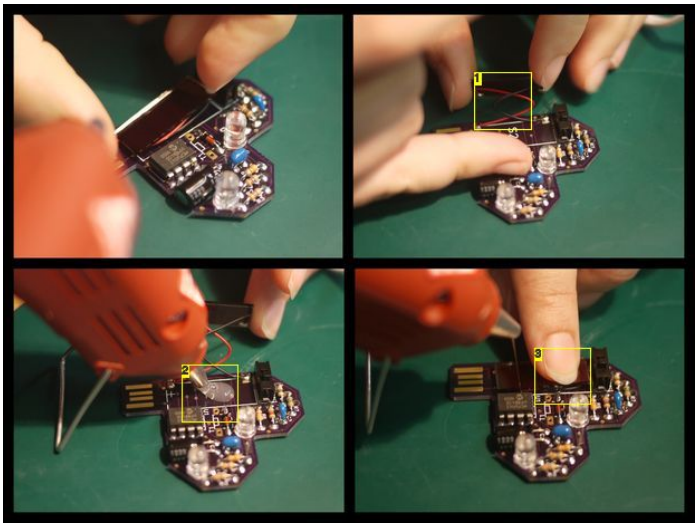


Image Notes
1. Coiled wires
2. Hot glue
3. Press

Step 10: FUNction!

The first time you charge your lovely heart we recommend conditioning the super caps. What does this mean? Charge it above and beyond full capacity and store this for a few hours. It keeps the caps from having a memory and undercharging. We also recommend cleaning off the flux with orange clean. The flux may corrode the leads over time. See the next step for details.

But you are probably impatient to PLAY WITH THE BLINKY!! We understand. The operation of the heart is super simple. It has two modes of behaving controlled by the switch. We call them "Store" and "Direct:

How to play:
1. Switch into “Direct” mode. The heart now gets its energy directly off the surrounding light. If it’s dark, NO blinky. If it’s bright, blinky awesomeness for all!
2. Not all light sources are the same, have fun figuring out which ones make the heart pulse.

How to charge:
1. Switch into “Store” mode.
a. USB – plug it in. Wait 4 minutes till the blue charging LED is really, really bright.
OR…
b. Solar – find a light source it likes and leave it there for 30-45 minutes. See step 2 of “How to play” to figure out what light it likes.
2. Enjoy the blinky awesomeness now.
Otherwise…

3. Store the charge for later by flipping the switch to “Direct”.

Endurance: In “Store” mode it'll run about 3 hours on a full charge in complete darkness. In “Direct” mode it'll blink as long as the room is bright. It's powered by SCIENCE!

Cleaning: Wash it with a warm damp soapy cloth. It may stop blinking when wet, don't panic. Let it dry out and it will start blinking. Do NOT put it in the dishwasher or washing machine (if you can help it). Both are too hot and may damage components.

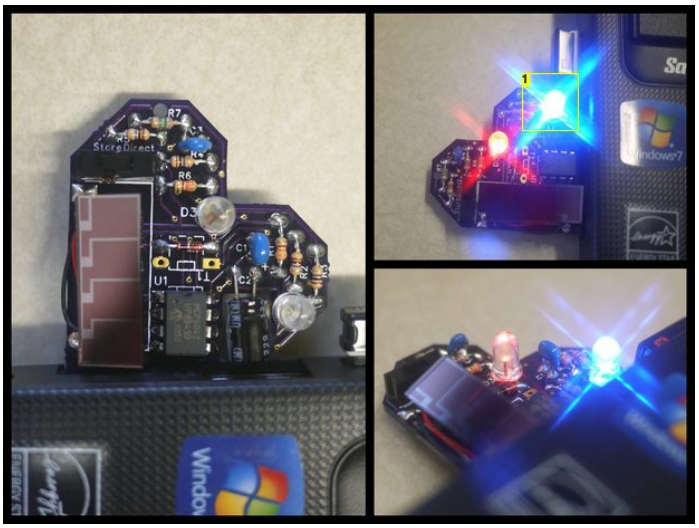


Image Notes
1. Blue charging LED

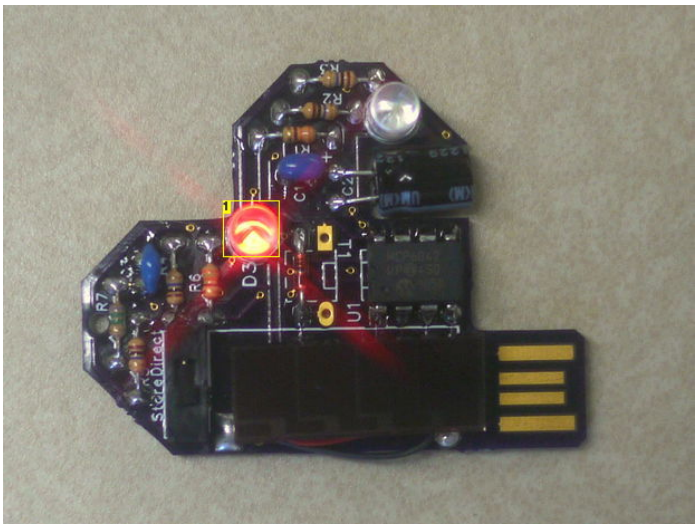


Image Notes
1. Red pulsing heart

Step 11: Extra Credit

You are welcome to string up your blinky awesomeness as a necklace, pair of earrings, key chain, or simply window dressing. You can also bond a pin onto the back and wear it on a backpack or shirt. However, make sure there is an insulating layer of epoxy or glue between the metal pin and the back of the circuit board. The purple heart is very low power, and can easily be shorted out by touching the back (or sweating on it, ew.) A metal pin will short out the heart and it won't work properly.

If you want to go the extra mile you can seal it in epoxy, which is easy to do. Here's how:

1. Clean it. Its best to remove the solder flux before sealing, so it doesn't discolor over time or corrode the metal.
a. The project must be completely dead before cleaning. Let it run down overnight or in a dark place, and keep the switch in "Store". Then when cleaning flip the switch to "Direct" so it doesn't re-charge.
b. We recommend full strength orange clean and a toothbrush to remove all the flux. Scrub it thouroughly.
c. Rinse with cold water
d. Allow it to dry overnight.

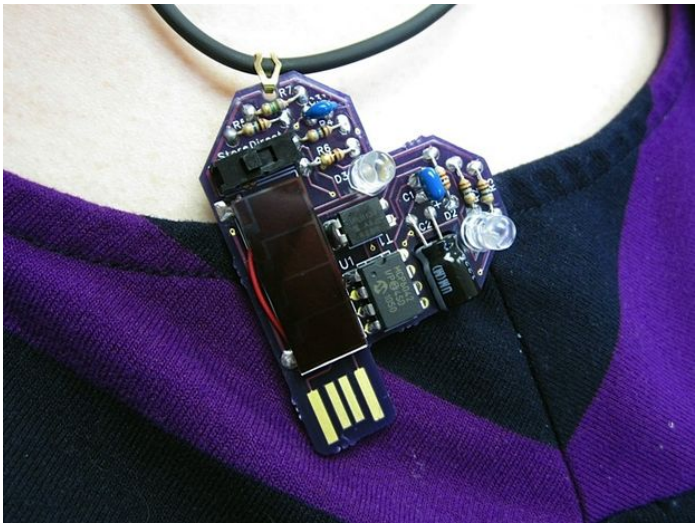
2. After cleaning, do your best not to touch it with your fingers. Rubber gloves are recommended. The oil on your skin may discolor the metal, and interfere with the epoxy adhering to the parts and board.

3. Clear 5 or 10 min epoxy will work great for sealing. Just work fast, it gets gummy quick and hard to work with. Mix up a small batch, not more than an ounce. You can always mix up more if you need it.

4. Using a disposable brush seal one side. Avoid sealing the switch,USB tab, and solar cell. Everything else can be covered with epoxy and continue working.

5 Allow the epoxy to completely cure. You'll know its done when it stops being sticky. This usually takes 12-24 hours, however don't be too impatient as un-cured epoxy will retain your finger prints. You want your blinky to be shiny don't you?

6. Repeat steps 4 and 5 for the other side. You're done!



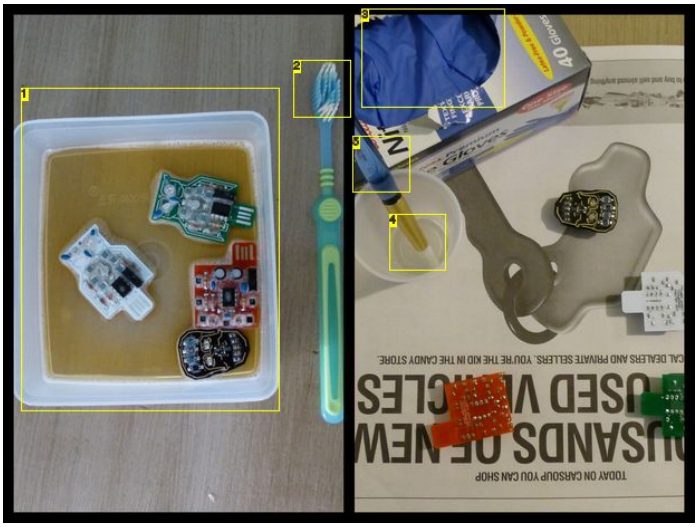


Image Notes
1. Orange clean
2. Toothbrush
3. Rubber gloves
4. Epoxy
5. Paint brush