Build Instructions, Printable Version

Step 0: Gather Tools

To build the Tactile Metronome, you will need a few common tools for soldering and electronics work. A soldering iron and solder are the most important tools. You can use any soldering iron, although a higher-quality, temperature-controlled adjustable iron will be easier to work with and give higher quality results. Any standard solder for small electronics will do just fine.

To bend the leads of the push buttons, you will need a pliers or similar tool. We used the pliers on a wire strippers. To trim the extra leads on the bottom of the pcb a diagonal pliers will work very well.

If you need some additional guidance and instruction on soldering, **SparkFun**, **NASA**, and **Curious Inventor**

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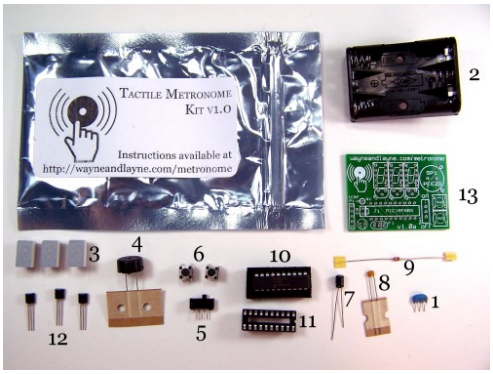
all have quality soldering tutorials.

Step 1: Part Identification

Open the bag of parts, and make sure you have all of the parts listed below. It might be easier to lay them out as shown in the picture. Click to enlarge.

1. (1) 8 MHz Ceramic Resonator
2. (1) 3 AAA Battery Holder
3. (3) Seven Segment LED Displays
4. (1) Piezo Speaker
5. (1) Power Switch
6. (2) Push Buttons
7. (1) 10 uF Electrolytic Capacitor
8. (1) 0.10 uF Ceramic Capacitor
9. (1) 10k Ohm Resistor
10. (1) PIC16F685 Microcontroller
11. (1) 20 Pin DIP Socket
12. (3) NPN Transistors
13. (1) Tactile Metronome PCB

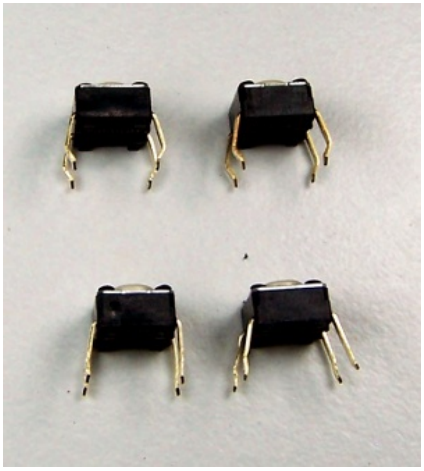


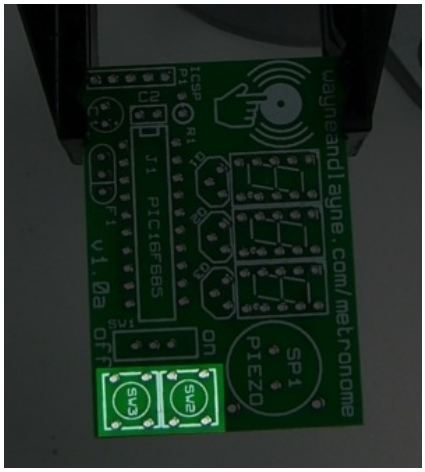
This kit is easy to solder. However, the seven segment displays can be a little tricky to get properly aligned. The alignment is made much easier if the assembly can be set on a flat surface while the seven segment displays are being soldered. To do this, we'll make sure to only solder parts that are shorter than the displays before getting to the displays. This will also give you a chance to practice your soldering on some easier parts with pins that are more spread apart, before getting to the trickier displays.

Some parts are **polarized**, and have to go in a certain way, but some parts are not polarized. In the steps to follow, if a part is polarized, we mention which way it must be installed. The PCB is also be marked to identify the polarization.

Step 2: Push Buttons

The push-buttons are used to adjust the settings of the Tactile Metronome, including pattern tempo and beep pitch. Use a pliers to straighten the legs of the buttons. They don't need to be perfectly straight. We want the plastic base of the button to press right up against the PCB.

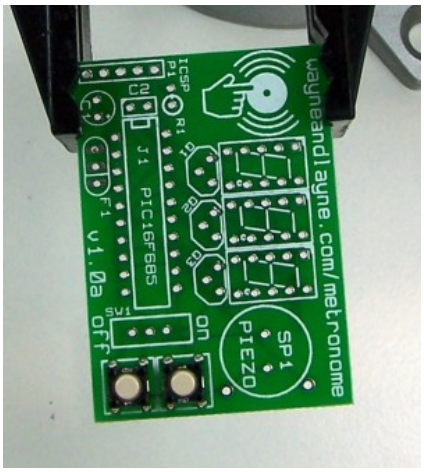


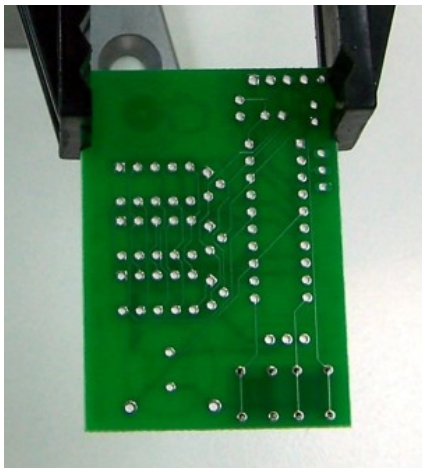


Place the two buttons on the PCB on the spots labeled SW2 and SW3. They should fit pretty snug. Turn the PCB over.

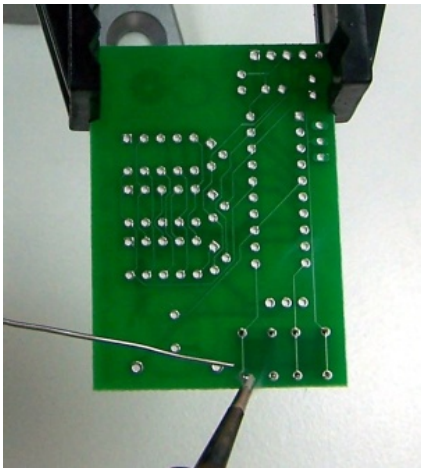
Archives

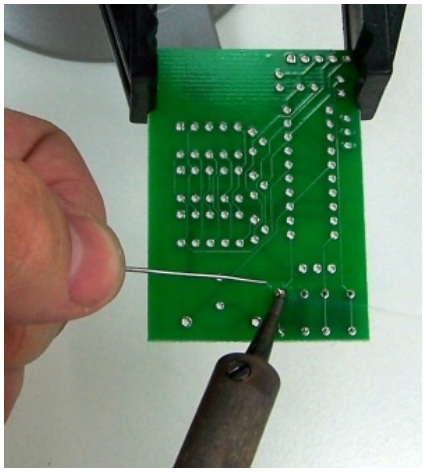
May 2011
April 2011
February 2011
January 2011
December 2010
November 2010
October 2010
September 2010
August 2010
July 2010
June 2010
May 2010





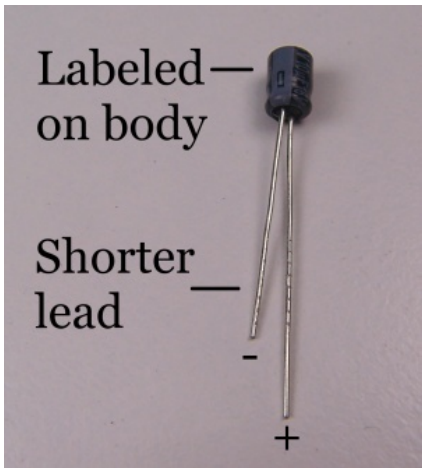
Use your soldering iron to heat up the leg of the button and the ring around the hole at the same time. Push a little bit of solder on the ring. The solder should melt and flow around the hole. If you're having trouble, make sure the tip of your iron is tinned and shiny. Remember to heat up the pad and the pin, and you don't need to apply a lot of solder. Don't try to use the iron like a paintbrush. Solder all four legs of each button.



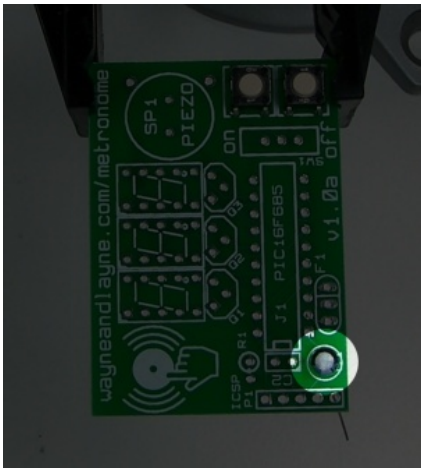


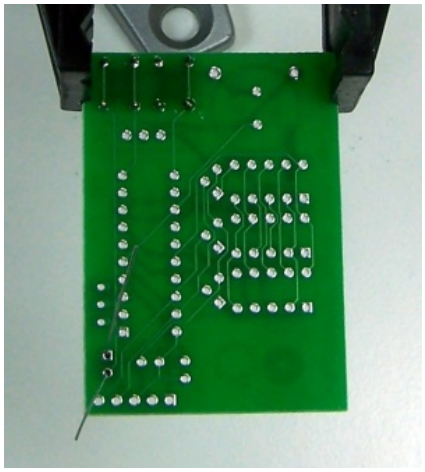
Step 3: Electrolytic Capacitor

Turn the board back over and put the electrolytic capacitor (C1) in the proper location, inside a circular marking on the board labeled C1. This part is polarized, with a positive (+) leg and a negative (-) leg. The negative leg is usually labeled on the side of the capacitor itself, and is shorter than the positive leg. The positive leg is labeled on the board with a small + sign.

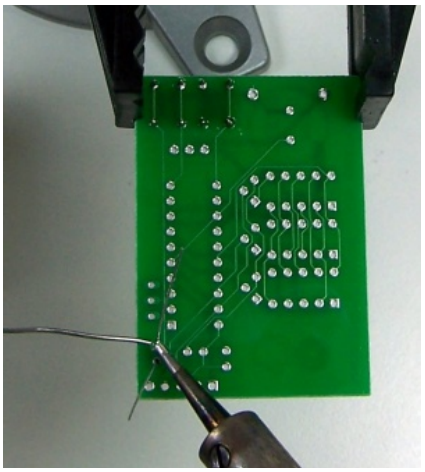


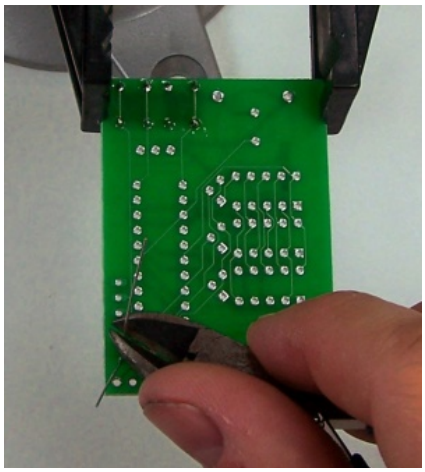
To solder things with long legs like this, you can turn the board over and bend the legs a little bit, so the component doesn't fall out while the board is upside-down.





Solder the both legs to the PCB. Use the diagonal clippers to trim the legs of the capacitor, down to just above the solder joints.

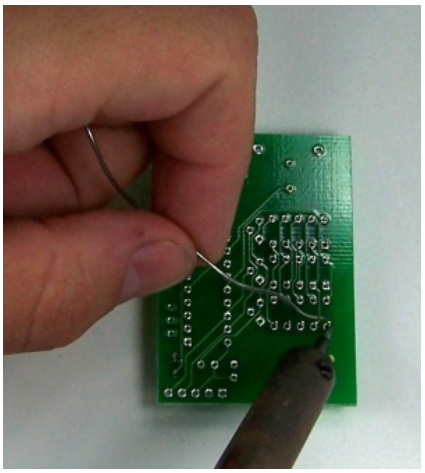


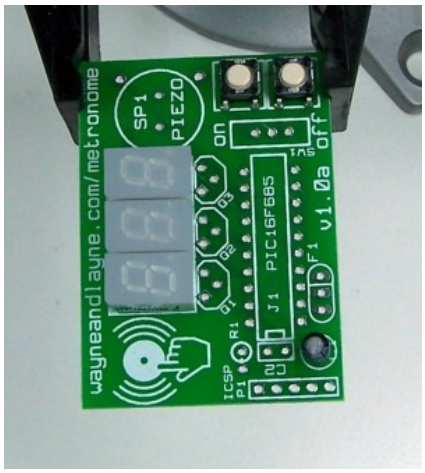


Step 4: Seven Segment Displays

Now that you've gotten warmed up and practiced some soldering, it's time to tackle the seven segment displays. Place the seven segments in the board, taking care to keep the decimal points at the bottom. Flip the board over and put it on a flat surface like a table. Solder one leg on each display, and flip the board back

over. Make sure the displays are firm against the board, and check for alignment.If the displays are crooked, you can reheat the junction and nudge the display. When you're happy with the alignment, solder the remaining legs of the displays. The pins might look too close together, but they're definitely solderable.

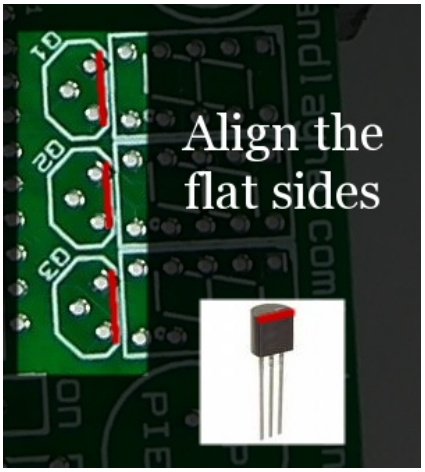


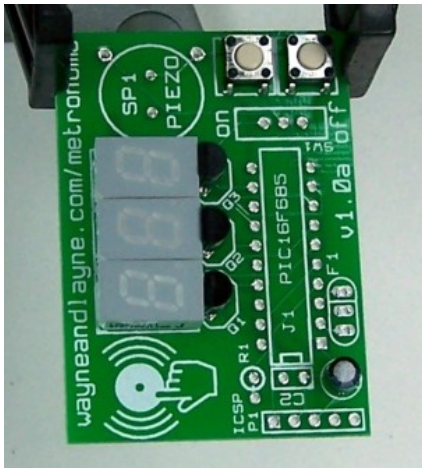


Whew! It's all downhill from here!

Step 5: Transistors

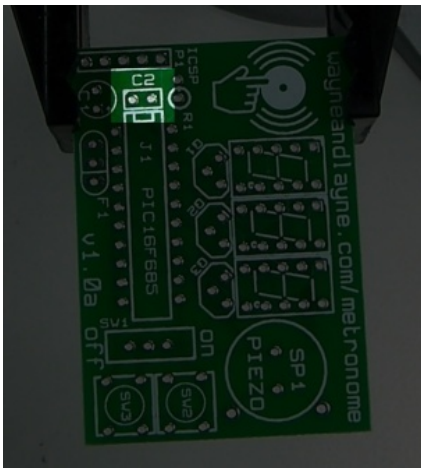
Next, insert and solder the transistors. They are labeled Q1, Q2 and Q3 on the board. The legs need to be spread a little to fit into the board. The orientation matters, so make sure to follow the white drawing on the board. Make sure the flat side of the black transistor package is facing the seven segment display.

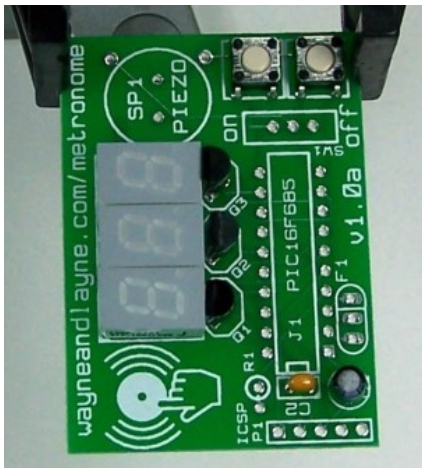




Step 6: Ceramic Capacitor

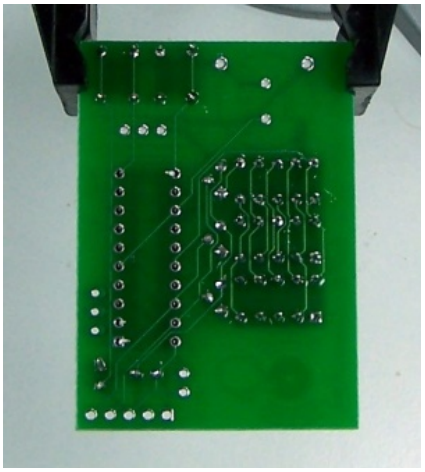
Insert and solder the ceramic capacitor, labeled C2 on the PCB. It isn't polarized, so it can go in either way.

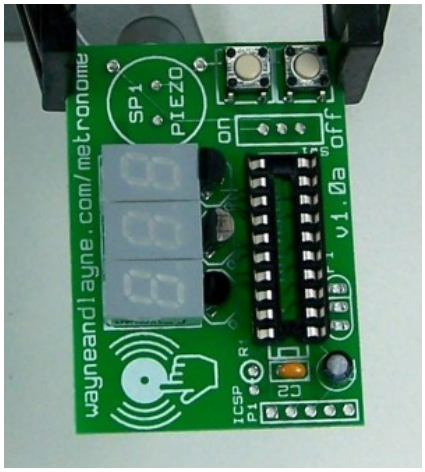




Step 7: Chip Socket

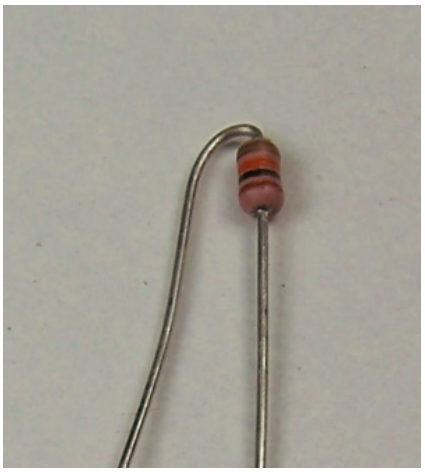
Insert the socket into the board. The footprint on the board is labeled J1. There is a notch in one end of the socket that should line up with the notch in the drawing on the PCB, next to the ceramic capacitor (C2) that was just installed. It usually helps to bend one of the legs to keep the socket in place while soldering. Take care to ensure that the socket is flush against the PCB while soldering, because it can be difficult to insert a chip into a crooked socket. Like the seven segment displays, you might want to solder only one pin at first, and then check the alignment. If the socket is crooked, you can melt that pin's solder and push the socket into place. Once it is aligned, solder the rest of the socket's pins.

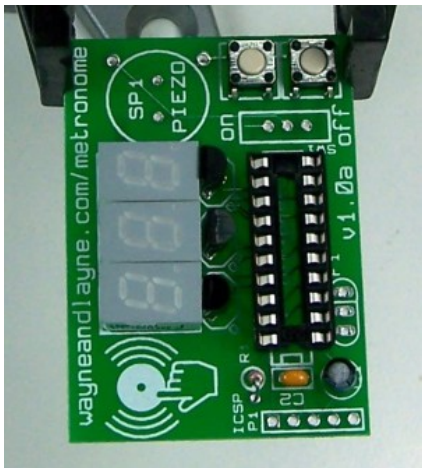




Step 8: Resistor

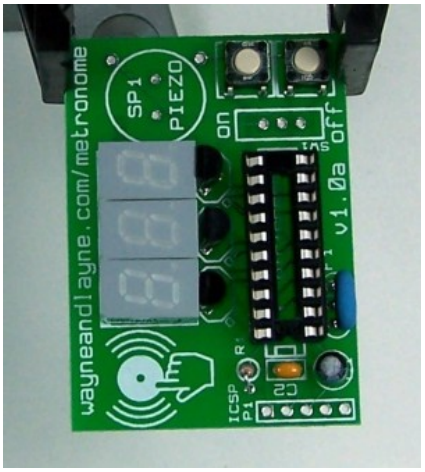
Bend the resistor as shown and place it on the board. It belongs just above C2, and is labeled R1. This part isn't polarized either. Solder it down and trim the legs.

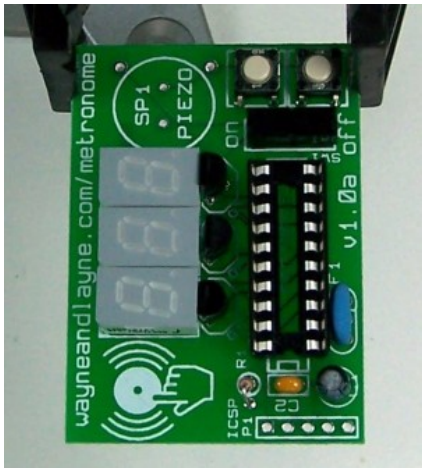




Step 9: Ceramic Resonator and Power Switch

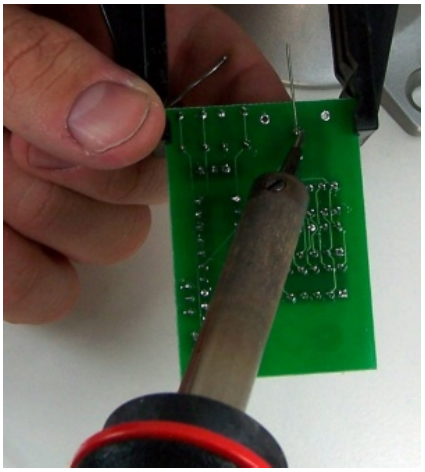
Insert the resonator (F1) and solder it down. Same goes for the power switch (SW1) . Both parts are not polarized, and can go either way into the board. There's a line on the resonator footprint, but please ignore it. It will be removed in the next board revision.

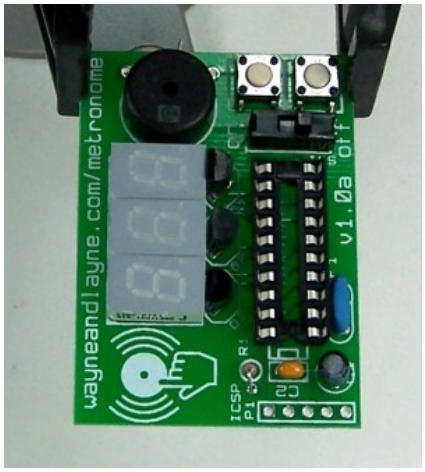




Step 10: Piezo Buzzer

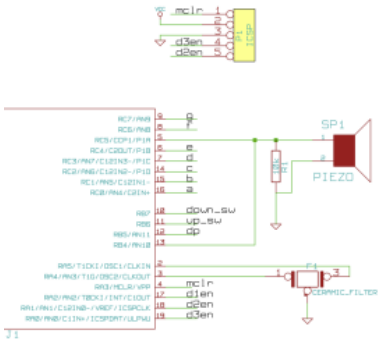
Place the piezo (SP1) into the board. You'll notice it has two little pegs underneath that keep the case off the board. Use your finger to keep those pegs pressed firmly and squarely on the board. Solder it, and clip the legs.





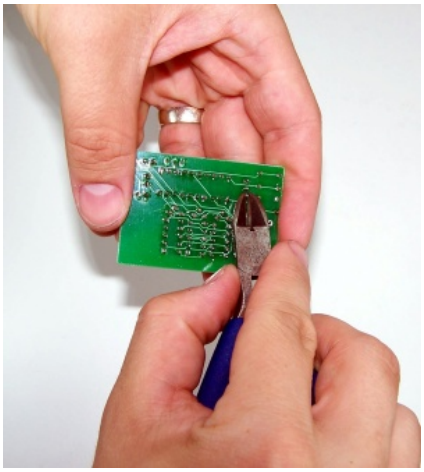
Step 11: In-Circuit Serial Programming Header (Optional)

If you want to solder the ICSP header for reprogramming the microcontroller, you can do it now. You can use either a straight or right-angle header. The header is not provided. If you don't have any header pins handy, you can unsolder the battery holder and attach the header later.



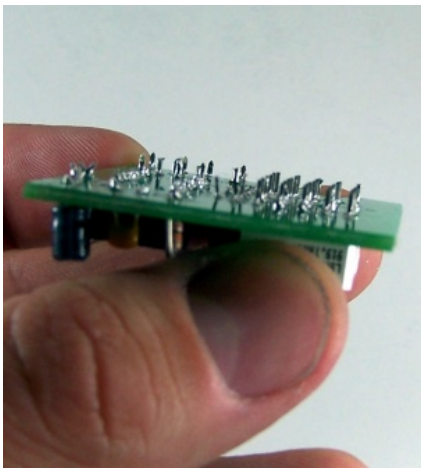
Step 12: Review

At this point, you should review your work. Are there any parts left over? Inspect your solder joints. Is there solder connecting any neighboring pads? There shouldn't be! Are any component leads hanging too long? If there is any wire past the solder joint, trim it off with the diagonal pliers. If you have a multimeter (you should!), you can measure the resistance between the two pads for the battery holder. It should say there's no connection, or have an extremely high resistance. If it says there's a low resistance or a short, review your soldering again and look for the short. In the picture below, the multimeter is measuring resistance, and the value "0.L" means that the measured resistance is out of range, and is too large to measure. This means there is an open circuit between the two battery pins, just what we need.

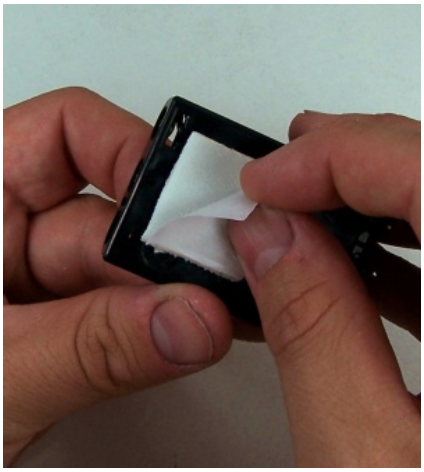


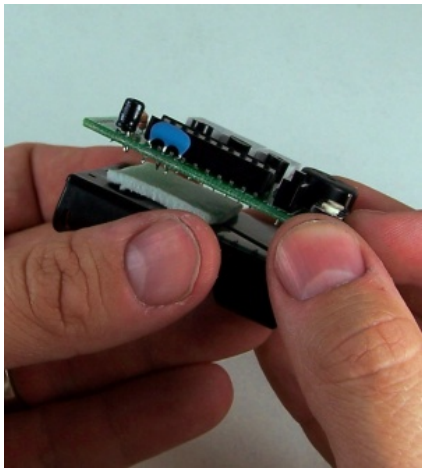
Step 13: Battery Holder

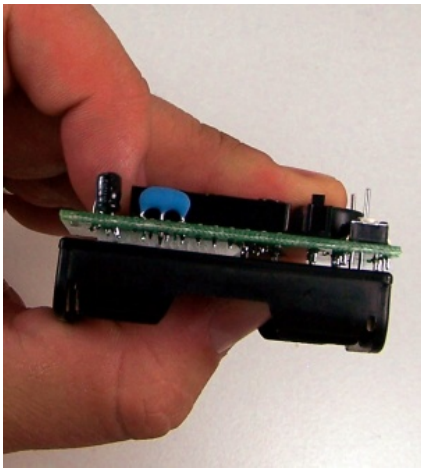
The battery holder is going to attach to the board with foam tape, and also be soldered. In the previous step you should have trimmed off any component leads that were too long, so take a look at your board's underside to make sure all the leads are trimmed down. Your battery holder may or may not already have the foam tape attached. If the piece of foam tape is not already attached, remove one side of the paper backing and firmly press the sticky side to the back (flat side) of the battery holder.



Remove the paper backing from the foam tape on the battery holder, and insert the legs of the battery holder through the back of the holes in the PCB and slowly press the battery holder against the PCB. Be firm, but be careful not to warp the battery holder by pressing unevenly. Solder the legs. These may take a little longer to solder–the thick legs can take a lot of heat. Clip the legs.



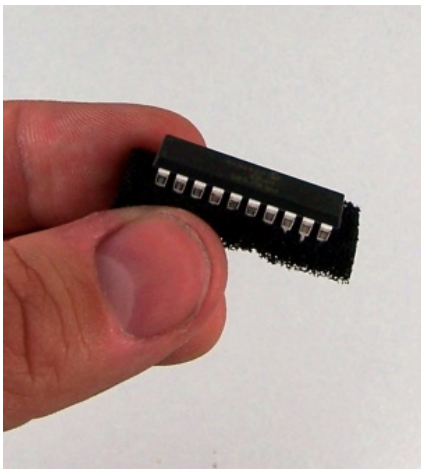


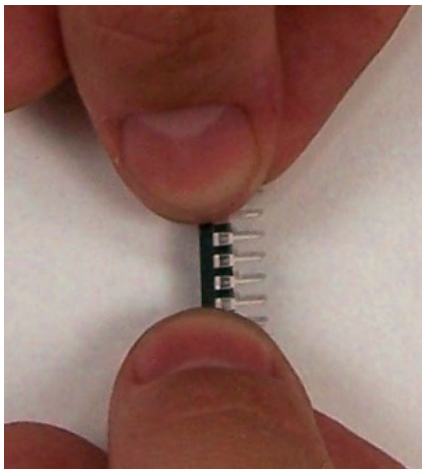


Step 14: Insert Processor Chip

Chips in DIP form usually have legs that are bent out too far to fit easily into sockets. One way to slightly (but uniformly!) bend the legs in is to press the chip against a table as shown in the photo. Insert the chip into the socket, taking care to get all the pins aligned in their holes. Make sure to put the chip in the right way! The

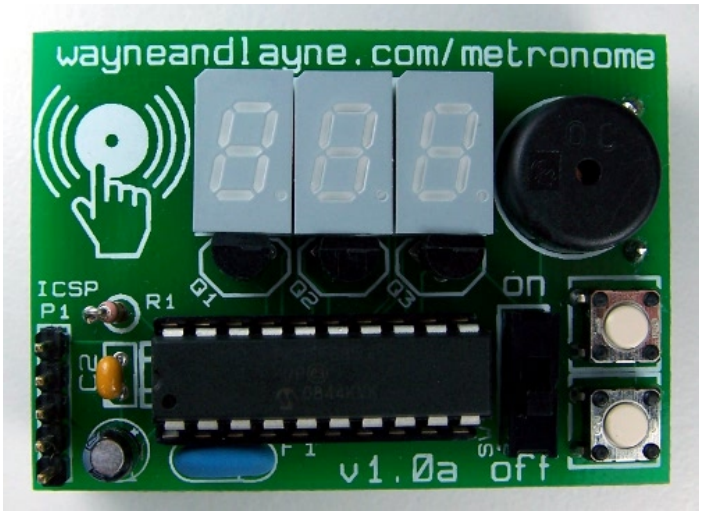
notch lines up with the notch on the board.





Step 15:

Give the completed board a final look over, checking for loose solder connections or shorted pads. Congratulations! You're now the proud owner of a Tactile Metronome. Install some AAA batteries and **give it a try!**



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About

Wayne and Layne, LLC makes open source hardware. Our kits come with easy-to-follow illustrated instructions and explanations of how the kit works. All the schematics, PCB artwork, and source code are provided under open licenses.

Our debut kit, the Tactile Metronome, is an easy-to-make tap tempo beat looper.

Upcoming Events

Wayne and Layne will be at the 2011 Bay Area Maker Faire.

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