



ohmHook

measuring and manipulating resistance



Measure and Manipulate



The ohmHook is crochet hook mounted on a circuitboard which measures the electrical resistance between the crochet hook and a crocodile clip connected to the opposite end of the tool handle. The resistance is displayed as the 10 bit reading of the microcontroller's analog-to-digital converter.

Having the ability to sense electrical properties of a material as you are manipulating it can allow you to explore its potential for creating electronics. Highly conductive materials make good connectors between physically distant electronic parts. Materials with stable electrical resistance can be used to detect location of contact on their surface. Materials with variable resistance often respond to forces such as stretch, pressure, bend and twist with a change in resistance, and can be used to sense a large variety of physical interactions.

The ohmHook does not have to be used for crochet. Use it to probe and explore all kinds of materials, and to invent new ways of building electronics.

components



3mm steel
crochet hook



ATtiny84
microcontroller that can
be programmed using
Arduino



HCMS-3906
4 digit dot matrix
alphanumeric display



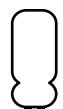
pushbutton
a surface-mount
momentary switch



thumbwheel
potentiometer
with a range of
500K Ohm



on/off switch
a surface-mount
slide switch



10uF capacitor

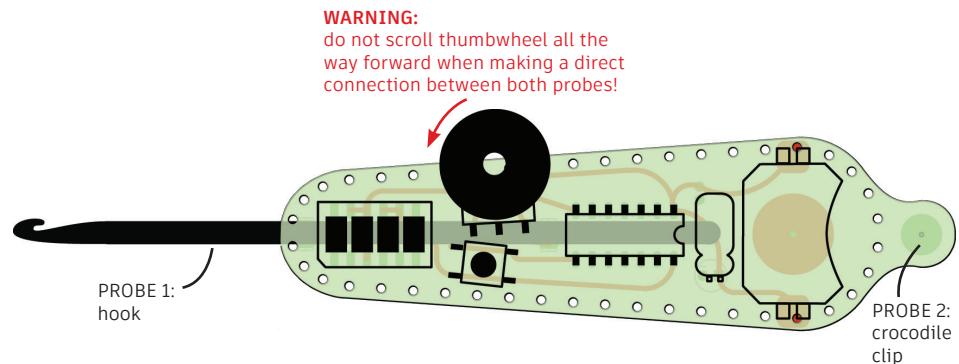


cr2032 coin-cell
battery holder



magnetic buzzer
transducer for
playing sound

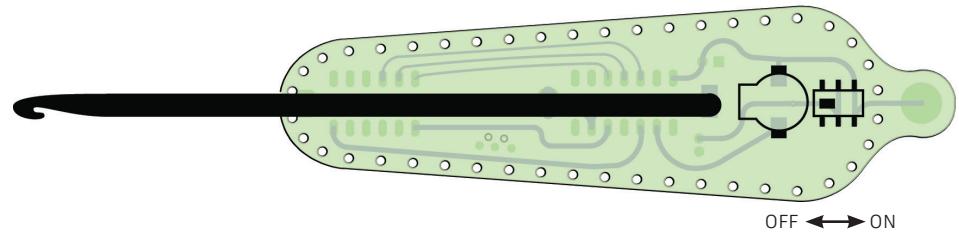
front side



modes:

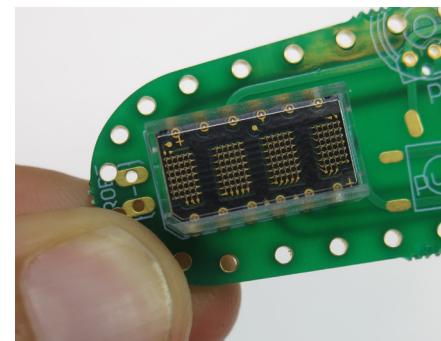
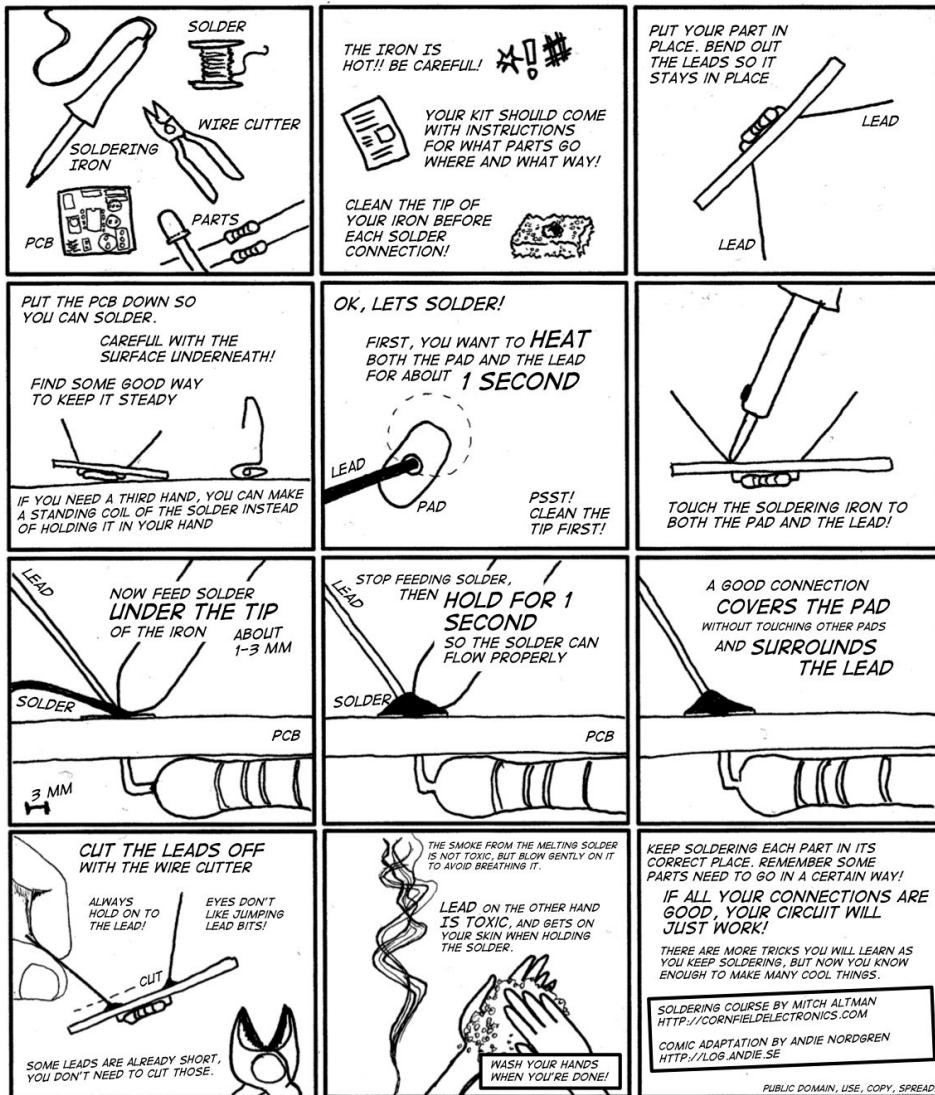
- 1: Analog Value: 10 bit ADC value [0-1023] between probe and GND
- 2: SYTH: synthesizes sound frequencies depending on the analog value
- 3: Pull-up Resistor Value: resistance of thumbwheel potentiometer
- 4: LITE: change brightness of display

back side

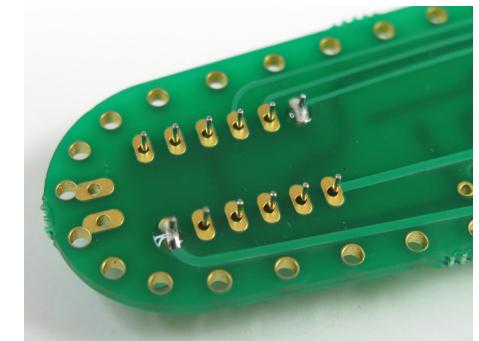


1 SOLDER

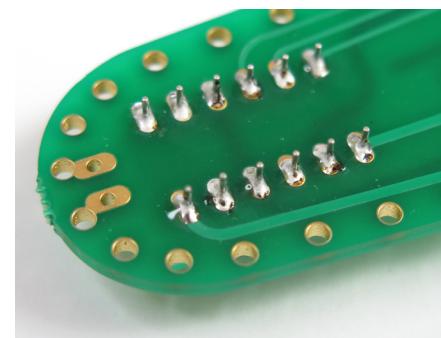
SOLDERING IS EASY HERE'S HOW TO DO IT



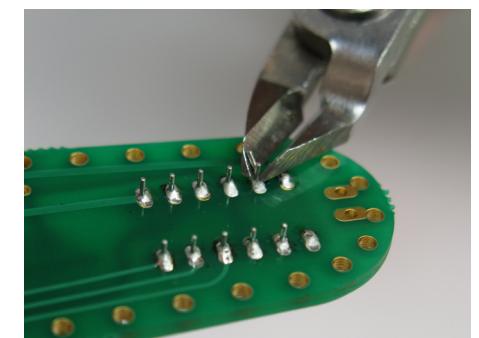
poke the legs of the display through the holes in the circuitboard. make sure the cut corner of the display lines up with the markings on the circuitboard.



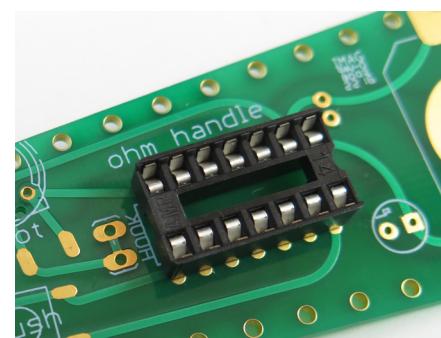
first solder two legs diagonally across from eachother. then check to make sure the display is flush with the surface on the other side before continuing to solder the remaining legs.



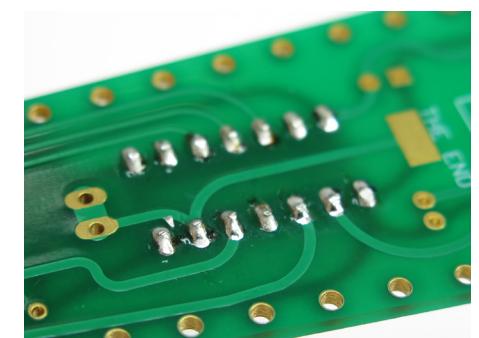
your soldering should look similar to this. try not to use too much solder, as the engravings in the acrylic casing need to fit over the solder joints.



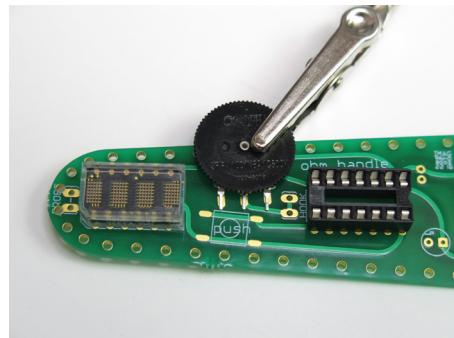
clip the remainders of the legs either now or later.



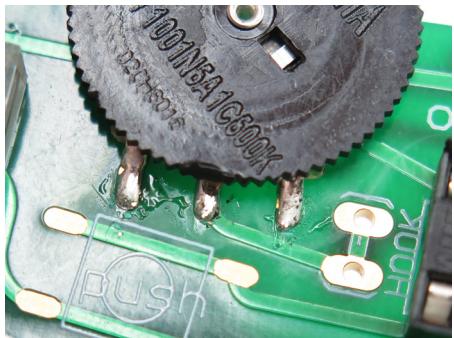
if you want to be able to reprogram the microcontroller, mount the socket in place of the microcontroller. this way the chip can be removed for programming.
if you don't care about reprogramming, then you can mount the microcontroller directly on the PCB.



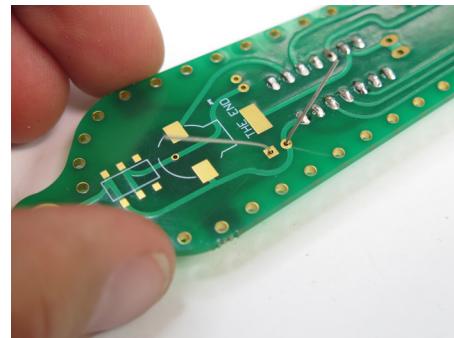
solder the legs of the socket like this.



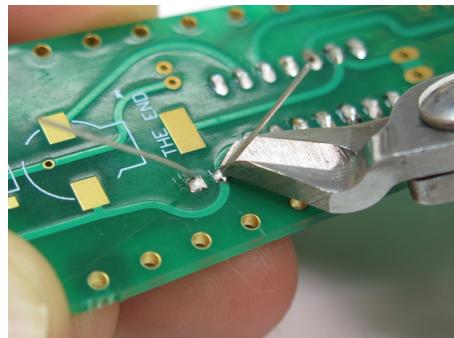
use a clip to hold the thumbwheel in place



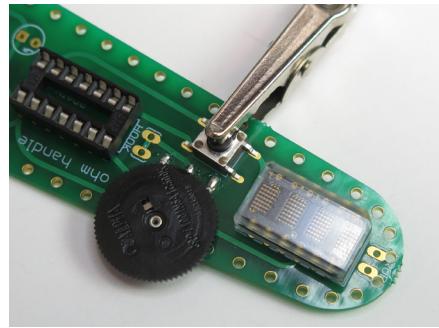
solder the three legs of the thumbwheel



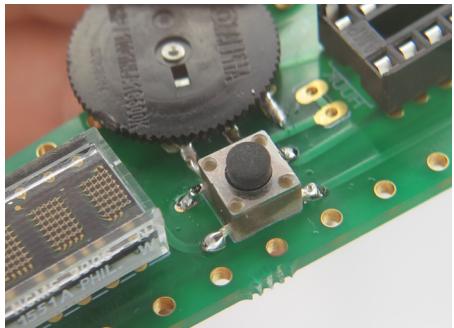
capacitor legs as seen from back side.



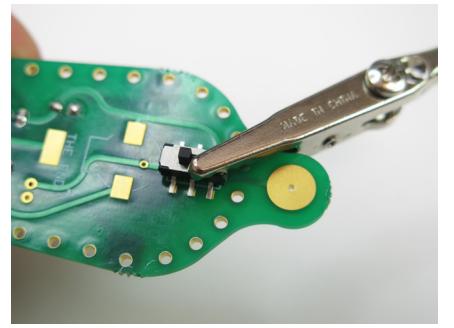
clip the remainder of the legs.



use a clip to hold the pushbutton (momentary switch) in place.



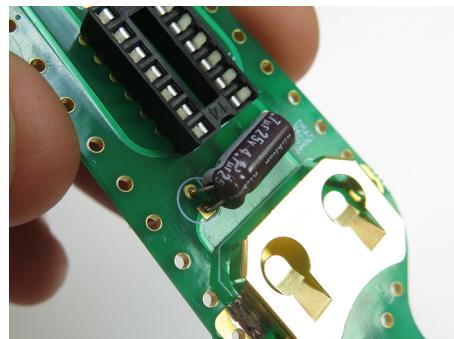
the solder joints of your pushbutton should look something like this.



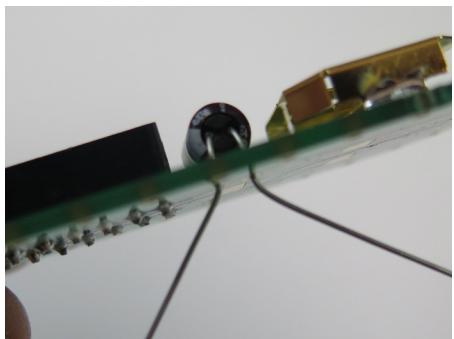
use a clip to hold the slide switch in place while you solder the leads.



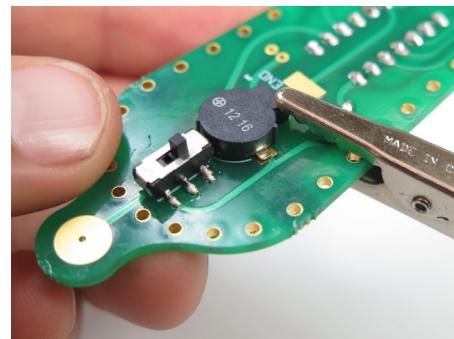
your soldering should look like this.



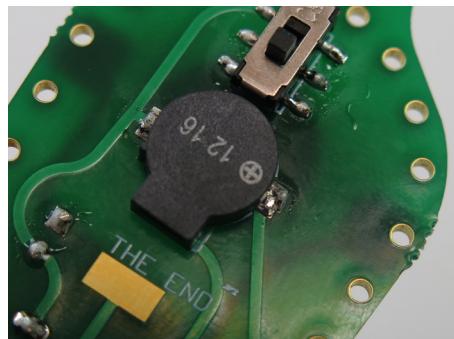
poke the legs of the capacitor through the circuit board. make sure the negative leg (marked by the white stripe) goes into the round hole.



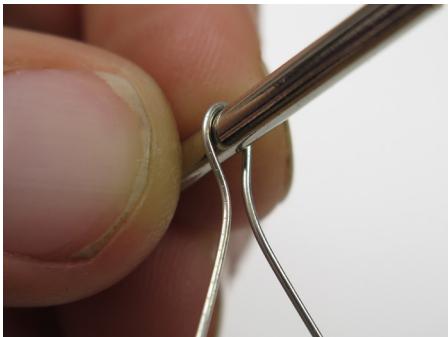
bend the legs of the capacitor on the back of the board to hold it in place while you solder it.



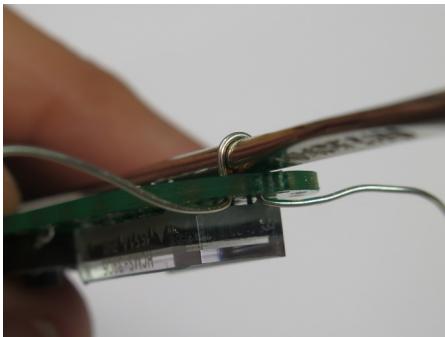
use a clip or your finger to hold the buzzer in place.



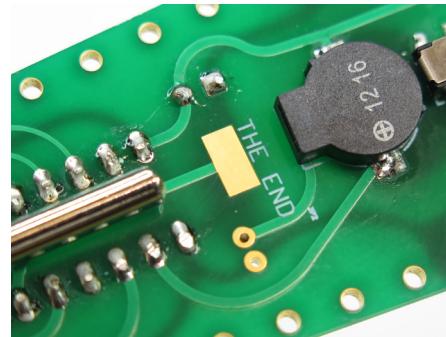
your solder joints should look like this.



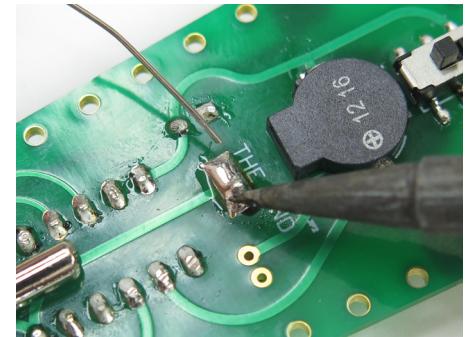
to make loops that will connect the crochet hook to the circuitboard, wrap some single-core wire around the shaft of the crochet hook.



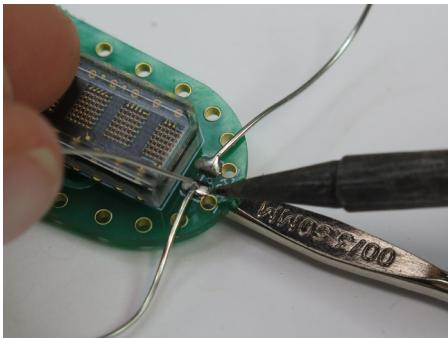
poke the leads of the wire through the circuit-board and pull them tight so that the crochet hook sits snug on the back side.



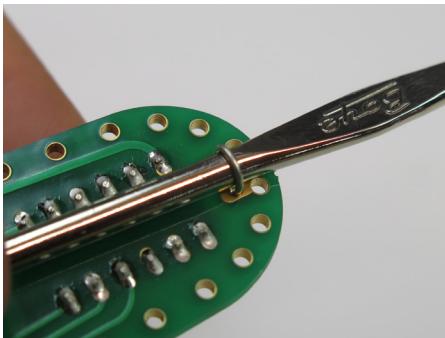
the rectangular solder pad marked THE END is intended to work in combination with the loops to insure good electrical contact between the crochet hook and the circuitboard.



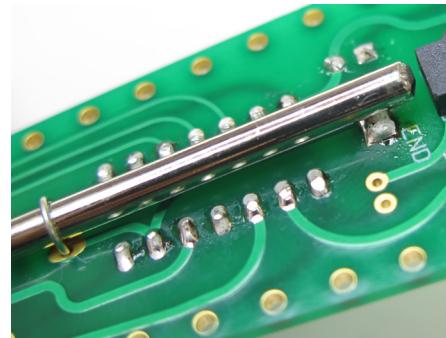
melt a pile of solder onto the solder pad.



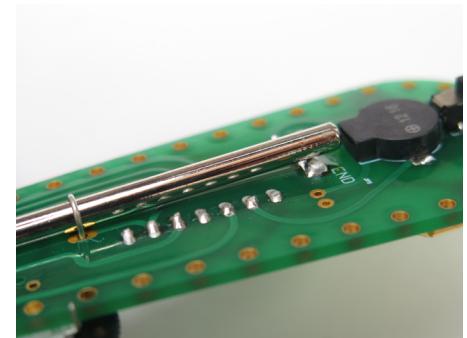
solder the wire to the pads on the front side of the circuitboard.



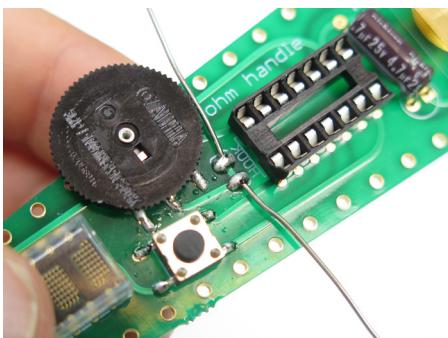
your loop should be tight like this.



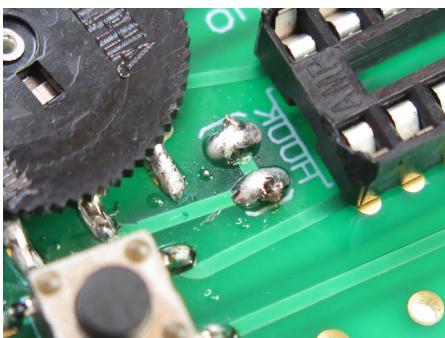
insert the crochet hook through the two loops and up onto the pile of solder at THE END.



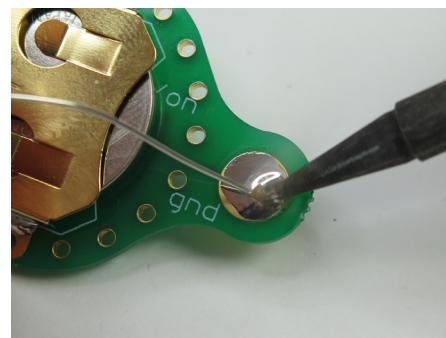
your crochet hook should rest tightly in this fixture. if not, you can add more solder to THE END or possibly tighten your loops, or re-do them.



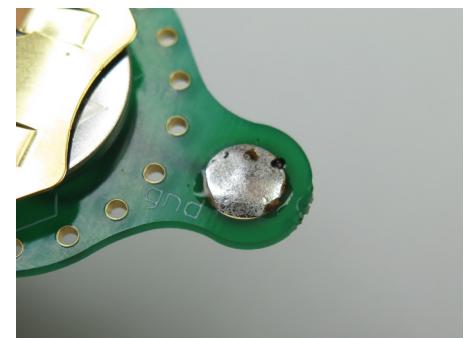
repeat the loop process through the holes in the center of the circuitboard.



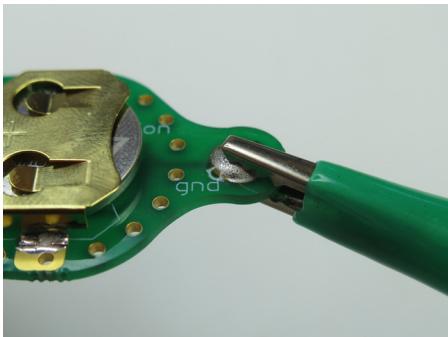
clip the remainder of the wire.



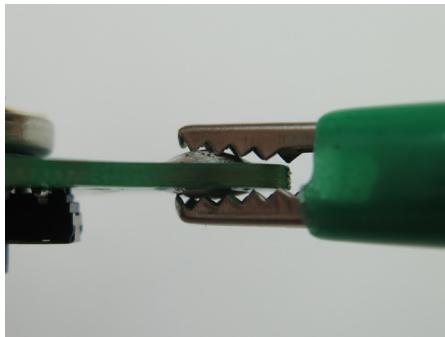
the large round solder pad at the back end of the circuitboard is intended as a connecting point for the second probe which will be a crocodile clip. again, add a pile of solder to this pad to improve electrical contact between the circuit and the clip.



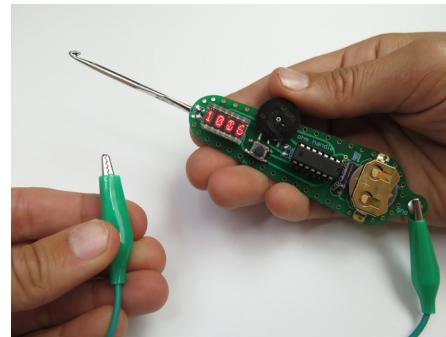
add piles of solder to both sides of the GND probe pads.



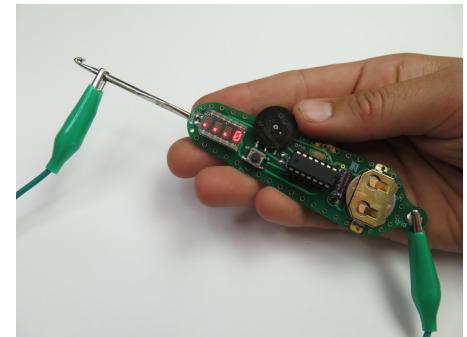
when you clip the crocodile clip to the GND probe pad it should make a sturdy connection.



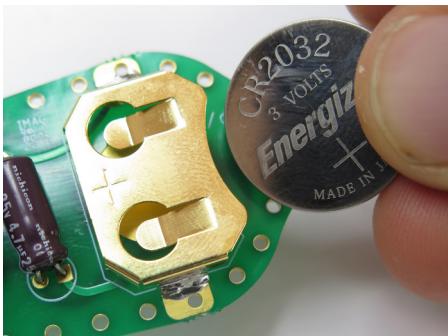
side view of the GND probe connection.



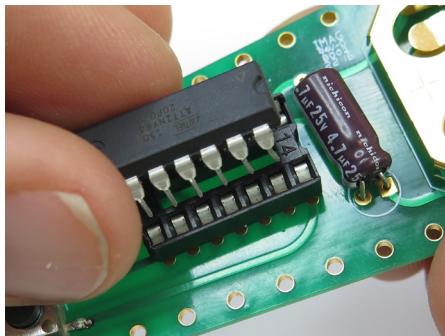
if all is good, then you should hear your ohmHook beep and the LED display should come on.



touching the probes together should result in a 0 resistance reading because they are in direct contact with one another.



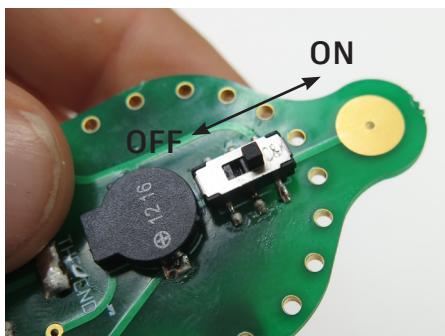
insert the 3V coin-cell battery with the positive side facing upwards.



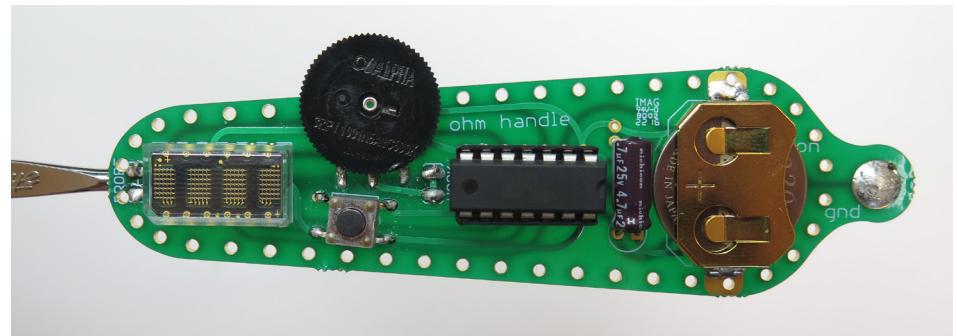
carefully insert the pre-programmed microcontroller into the socket, making sure the indent on the microcontroller aligns with that on the socket. the legs of the microcontroller are delicate and can break during this process.



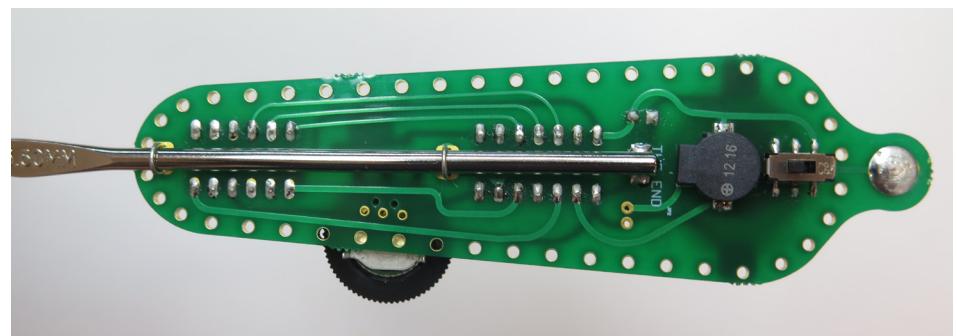
the microcontroller should sit snug in the socket.



flip the slide-switch to ON position!



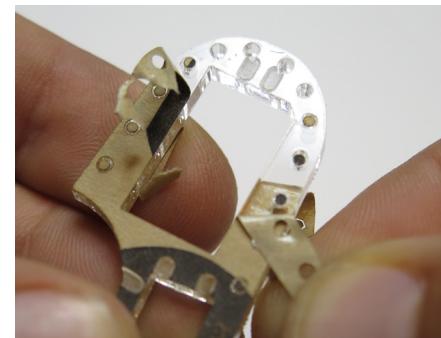
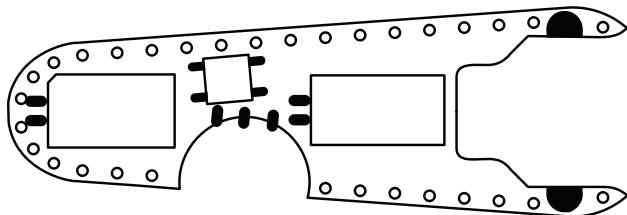
the front side of the populated circuitbaord.



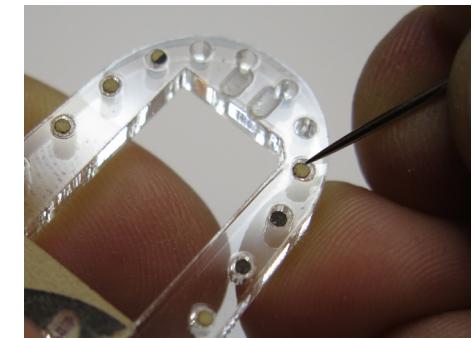
the back side of the populated circuitbaord.

2 ASSEMBLE

front acrylic panel

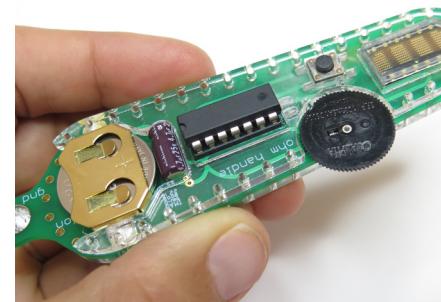
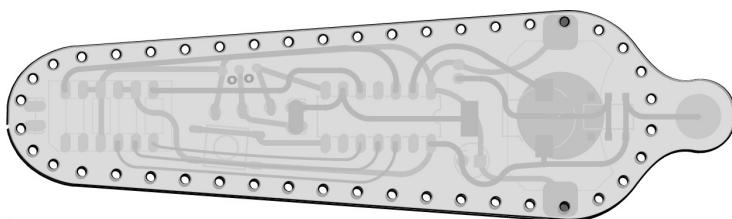


remove the backing from both sides of your acrylic panels.

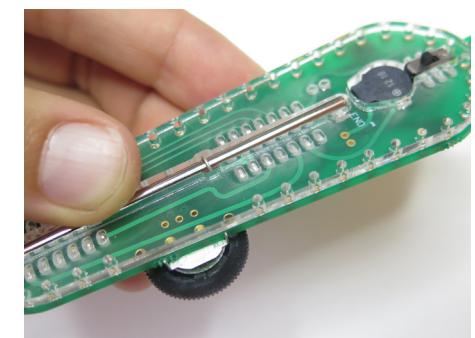


use a sewing needle to poke out any clogged holes.

printed circuitboard (PCB)

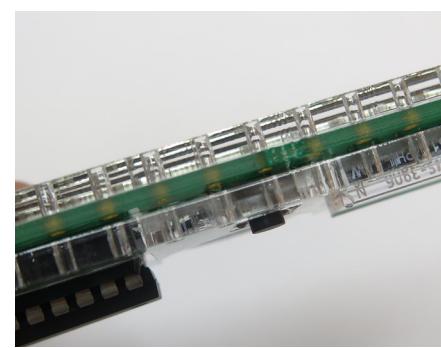
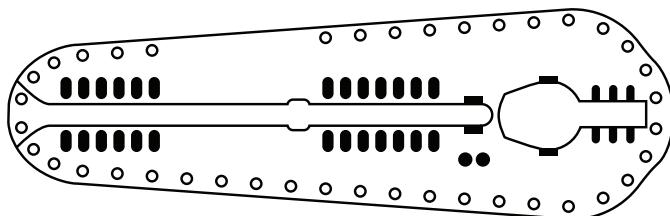


make sure all your soldered legs have been clipped short.
place the front acrylic panel over the front side of the circuit. it should fall into place so that it aligns with the outline of the PCB.

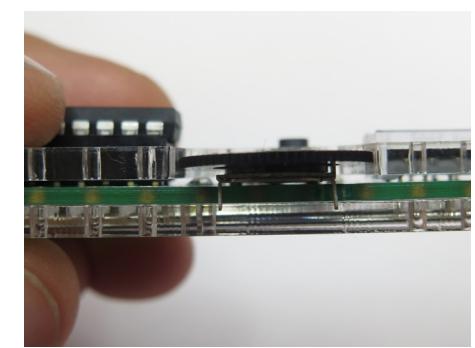


place the back acrylic panel over the back side of the circuit until it falls into place.

back acrylic panel



looking at the layering of front and back panels with the circuitboard in between, there should be only a very minimal gap between them.



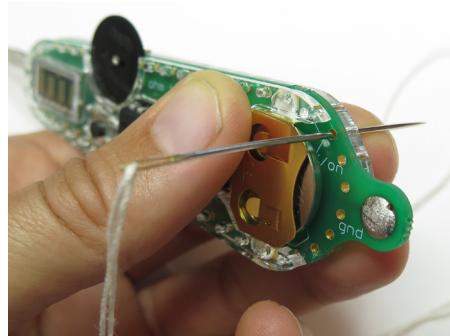
closeup of layering.

3 SEW

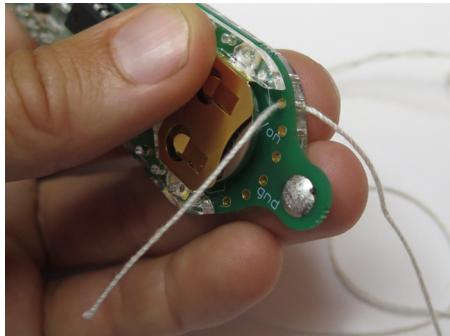
if the panels of acrylic fit nicely on your circuitboard and the circuit still works, then you are ready to sew your ohmHook together.



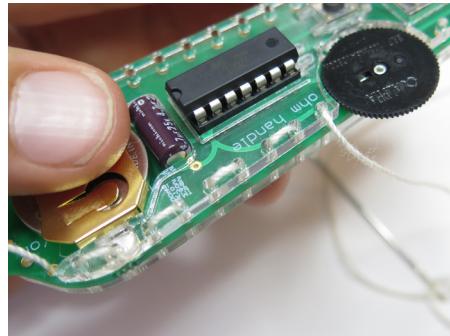
cut a length of about 1.5 meters of thick thread. thread one end through the eye of a sewing needle.



begin by sewing from one side to the other.



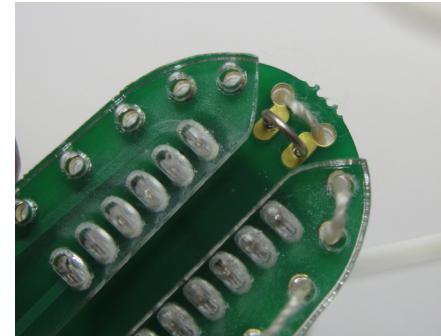
leave a short length (about 10 cm) of thread behind.



stitch in and out along the holes of your ohmHandle. when you reach the thumbwheel, turn around by stitching back on yourself and filling the spaces you previously skipped.



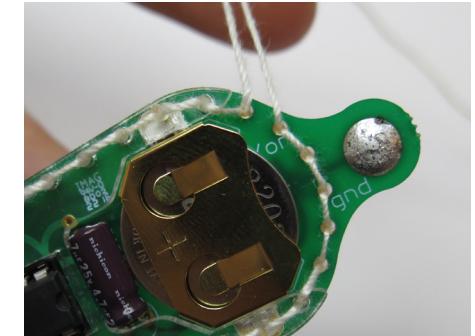
after stitching back on yourself, your sewing should look like a dashed line with no spaces between.



at the tip of the ohmHook, sew the thread underneath where the crochet hook will go.



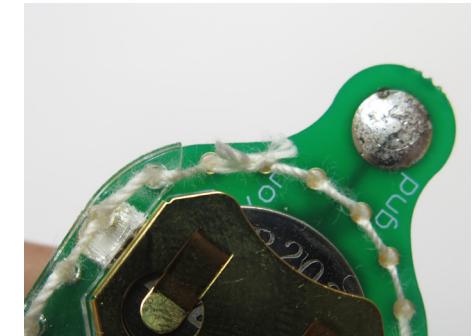
side view of sewing.



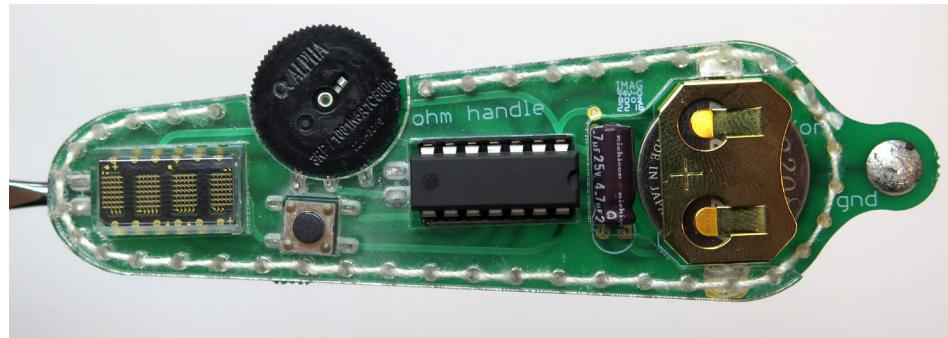
with the same lenght of thread, stitch all the way around the circuitboard and return back to your starting point.



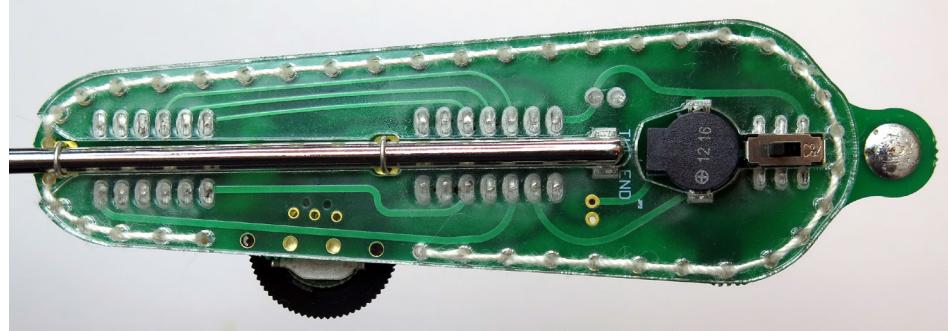
tie two knots in the ends of the thread.



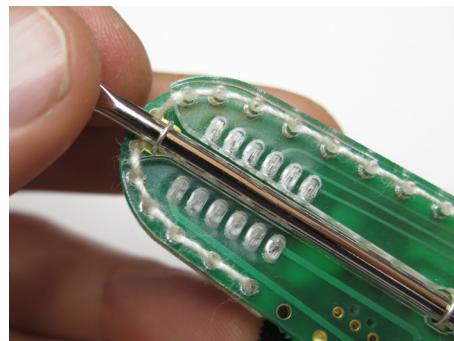
cut the threads short. Done!



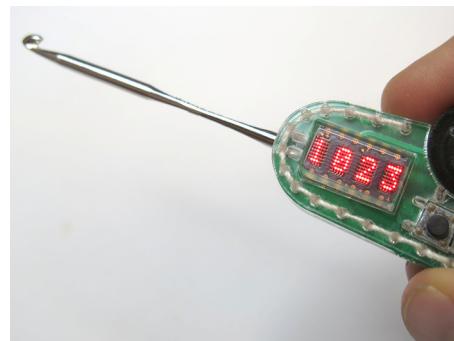
the front side of the ohmHook.



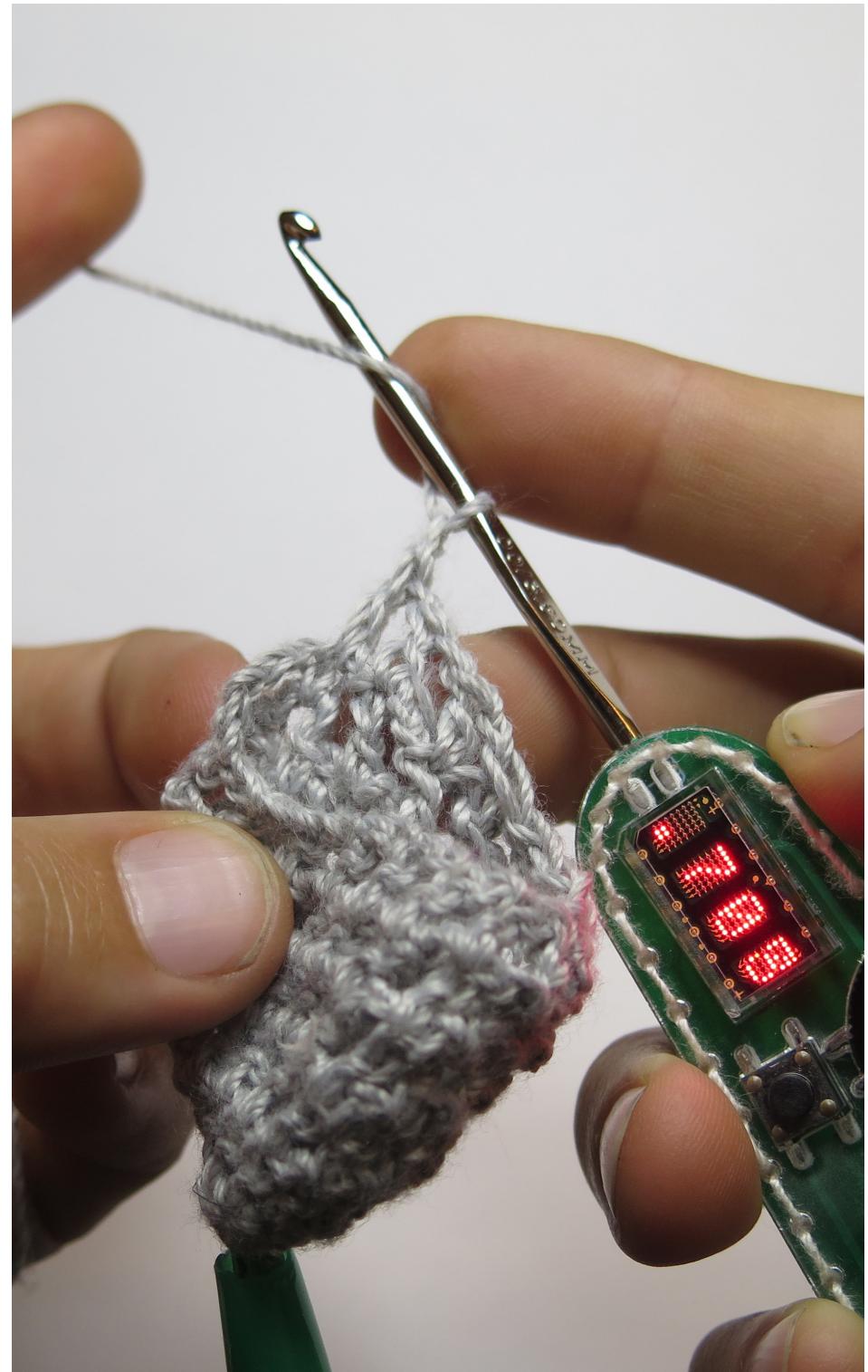
the back side of the ohmHook.



insert the crochet hook should above the sewing
stitch.



turn your ohmHook back on to make sure it still
works.



HOW TO CROCHET

Simple Illustrated Instructions

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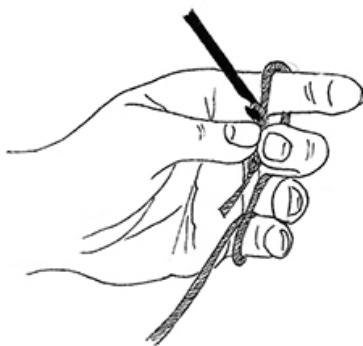
HOLDING YOUR YARN

Properly wrapping and holding your yarn is the best way to keep your yarn steady and your crochet tension even. [For left handers, simply hold this picture up to a mirror so that you can see the illustrations in a reverse reflection.]

SIDE VIEW



FRONT VIEW



HOW TO CROCHET

Simple Illustrated Instructions

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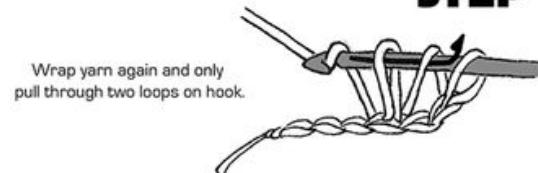
DOUBLE CROCHET (DC)

A commonly used stitch for crochet patterns.

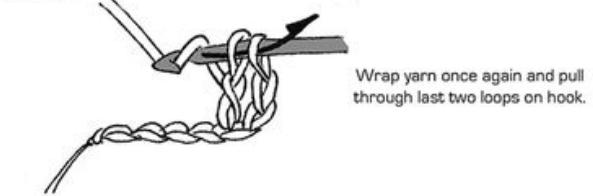
STEP 1



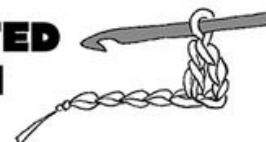
STEP 2



STEP 3



COMPLETED STITCH



Materials



Silversun Yarn

87% combed cotton, 5% silver, 5% nylon,
3% Spandex



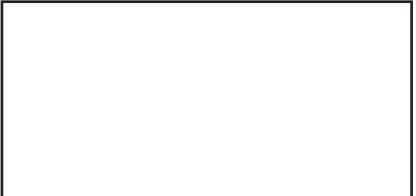
Stainless Steel with Polyester Yarn

polyester (80%) and stainless steel (20%),
very strong and completely corrosion resis-tant



Karl-Grimm High-Flex 3981 Copper Thread

copper metal spun with a strong synthetic core



Stretch Conductive Fabric

medical grade Silver plated 76% Nylon, 24% elastic fabric, stretch in both directions



Circuitex

silver coated nylon



SaniSilver

one-sided Pure Cotton, other is Conductive Silver



Velostat

carbon impregnated black polyethylene film



RadioClear

The polyester film contains a grid so fine that it is nearly impossible to see it, the grid is a diamond pattern



Fusible Interfacing

iron-on heat glue for fabrics, non-conduc-tive



Eontex LT-SLPA-2K

carbon doped knit stretch fabric



Eontex NW170-SLPA-2K

carbon doped non-woven fabric

This ohmHook booklet was produced for the
E-Textile Tooling workshop at Eyeo Festival 2016

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www.github.com/plusea/ohmHook