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Tick Tock Shield Soldering Guide

Congratulations on your purchase of the Tick Tock shield! In this guide, we will explain how to assemble the Tick Tock Shield. By the time we're done, you'll have a snazzy new clock and learn how to solder in the process.

Let's roll up our sleeves and get soldering!

For more information go to: wwww.seeedstudio.com

Catalogue

Assuming this is your first soldering project, let's gather the tools and components to get started.

Tools

Only three basic tools are needed. If you don't already have them on hand, then you will need to purchase them. They will be used time and time again for your soldering projects, so if you have the available funds, choose tools that are well made.

1. Soldering Iron

You will need a basic soldering iron, a base to hold it, and a wet sponge. If possible, a soldering station, as seen in the picture above, is preferable because it includes an iron, a stand, a sponge, and a power unit.

The power unit is nice because you can maintain a constant temperature. At the very least, a soldering iron with a pencil shape and a fine point tip is recommended. Please do not use a soldering gun. These can damage sensitive electronics because they generate an electromagnetic spike.

2. Solder

Solder is to DIY electronics as glue is to paper. It is an alloy used to join two metal surfaces together.

3. Flush Cutter

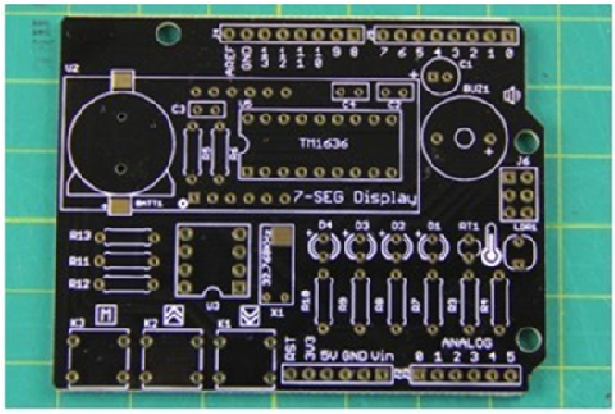
A flush cutter is a nipper/pincer for cutting off excess electronic component leads.

Electronic Components

We will go over the contents of your kit in the order that they will be soldered.

1. Base Board

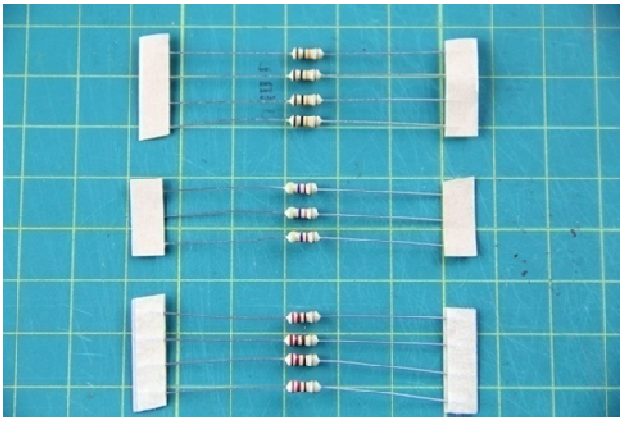
The base board is our starting point. The silk screen images indicate where all of the electronic components/parts will be attached to the board.



2. Resistors

A resistor is an electrical component that regulates the flow of electricity in a circuit. This project uses three different kinds of resistors which are listed in the chart below.

The color code contains the value or rating of a resistor. Want to know more? Check out the wiki page on electronic color codes. Master it and then you can distinguish one resistor from another.



Resistor Type	Location(s)	Qty	Notes
10k resistor	R3, R4, R5, R6	4	Color code: Brown, Black, Orange, Gold
220 ohm resistor	R7, R8, R9, R10	4	Color code: Red, Red, Brown, Gold
4.7k resistor	R11, R12, R14	3	Color code: Yellow, Violet, Red, Gold

3. LEDs, Sensors & Crystal

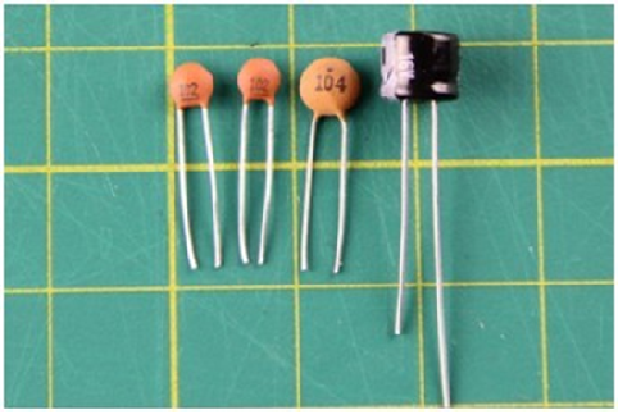
We have 4 LEDs, shown in the first row in the picture above. There is one green LED, two red LEDs, and one blue LED. Please note that the leads of an LED are not the same length. The longer one is anode, where the current enters the LED, and the shorter one is cathode, where the current leaves the LED. You will want to be aware of this when inserting them onto the base board as they will not function if inserted the wrong way.

In the second row, from left to right, are a crystal, a thermistor and a light dependent resistor. They are not polarized, meaning it doesn't matter which way they are inserted into the board.

Component	Board Location(s)	Qty	Notes
Blue LED	D1	1	3mm, polarized
Green LED	D2	1	3mm, polarized
Red LED	D3, D4	2	3mm,polarized
Crystal	X1	1	32.768k
Thermistor	RT1	1	
Light dependent resistor	LDR1	1	

4. Capacitors

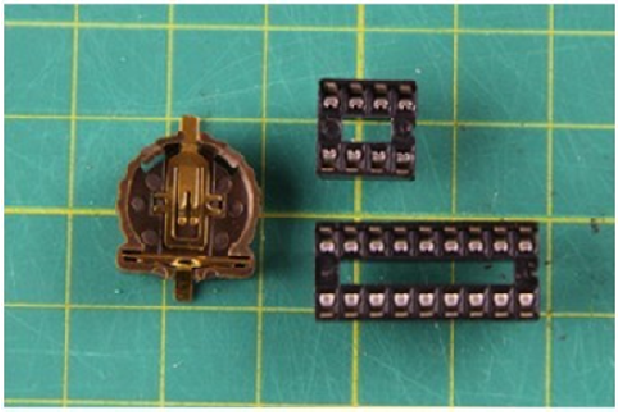
In layman's terms a capacitor is like a water tower for electricity. It collects and stores the electrical energy in your circuit. Larger capacitors have their electrical characteristics labeled on them. For example, the black one above has "100uF/16V" printed on it. While smaller capacitors have abbreviated characteristics printed on them. In order to decipher a smaller capacitor's value, you can use the following equation, $C = XY \times 10^{Z}$ (pF), to calculate it. Where the three digit number printed on the capacitor represents XYZ respectively.



Capacitor Type	Board Location(s)	Qty	Notes
100uF/16V cap	C1	1	Electrolytic capacitor, black one
100nF cap	C2	1	Ceramic disc capacitors (104)
1nF ceramic disc capacitors	C3, C4	2	Ceramic disc capacitors (102)

5. Coin Cell Holder & IC Sockets

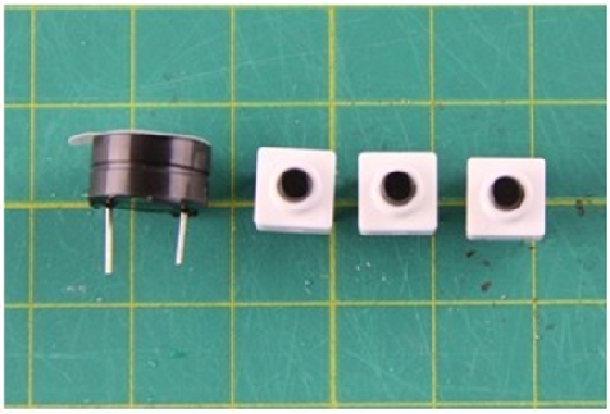
The round object on the left is a coin cell battery holder. The other two items on the right are IC sockets. They house IC chips and allow them to be easily added or removed from the board.



Component	Board Location(s)	Qty	Notes
8-pin socket	U3’	1	To hold the DS1307 RTC chip
12mm coin cell holder	U4’	1	To hold the coin cell battery
18-pin socket	U5’	1	To hold the TM1636 7-seg display driver

6. Buzzer & Buttons

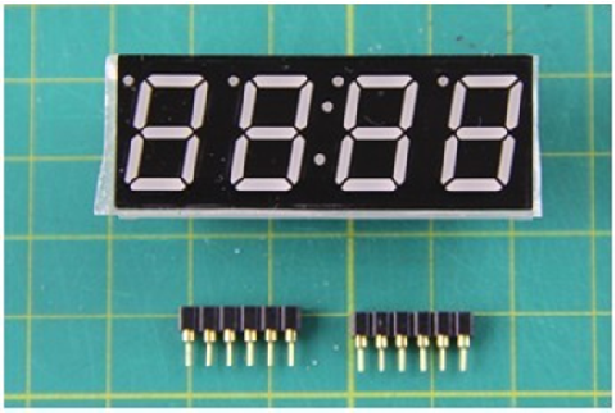
There is one buzzer and three buttons.



Component	Board Location(s)	Qty	Notes
Buzzer	BUZ1	1	12mm
Button	K1, K2, K3	3	Temporary tactile button

7. 7 –segment Display

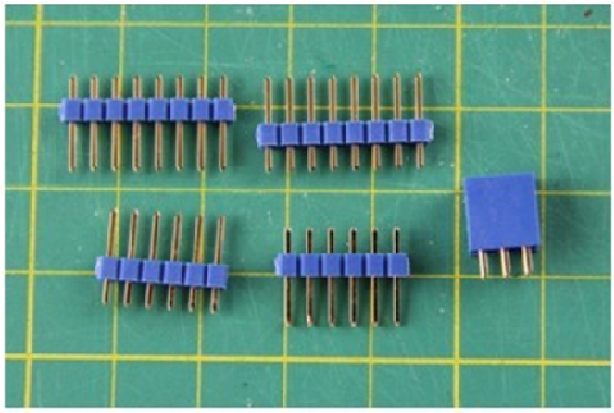
There is one 7-segment display and two 6-pin female headers. The headers will enable us to attach the display to the board.



Component	Board Location(s)	Qty	Notes
7-seg display	U2	1	2'' 4 digits
6-pin female header	U2	2	

8. Stacking Headers & ISP Header

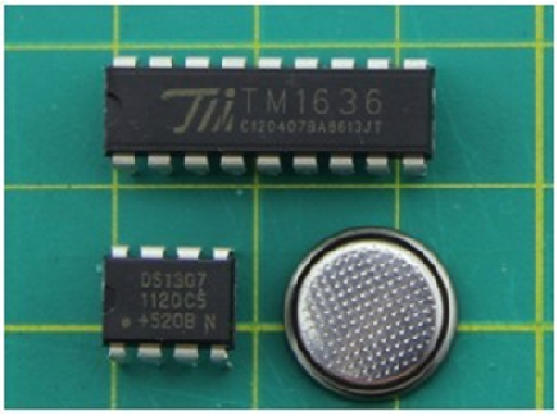
These headers will be used to stack the shield on top of the Arduino.



Component	Board Location(s)	Qty	Notes
6-pin header	J2, J3	2	
8-pin header	J4, J5	2	
ISP female header	J6	1	2 x 3

9. Chips & Battery

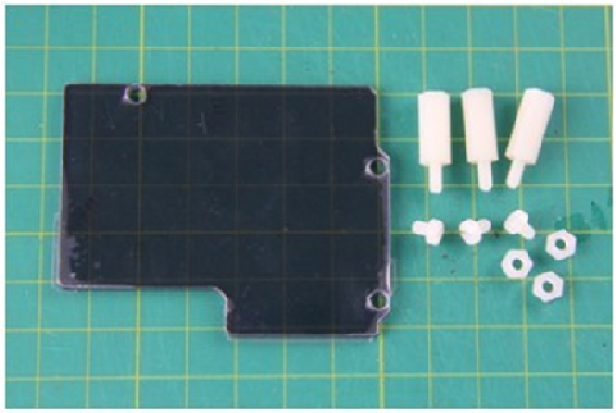
The two chips, also known as ICs or integrated circuits, and a battery are added to the board in order to prevent any unintended heat damage from soldering.



Component	Board Location(s)	Qty	Notes
RTC chip	U3	1	DS1307
Lithium coin cell	U4	1	12mm 3V, CR1220
7-segment display driver	U5	1	TM1636

10. Acrylic Shell & Standoffs

The acrylic shell protects the shield from dust and damage. The standoffs support the shell.



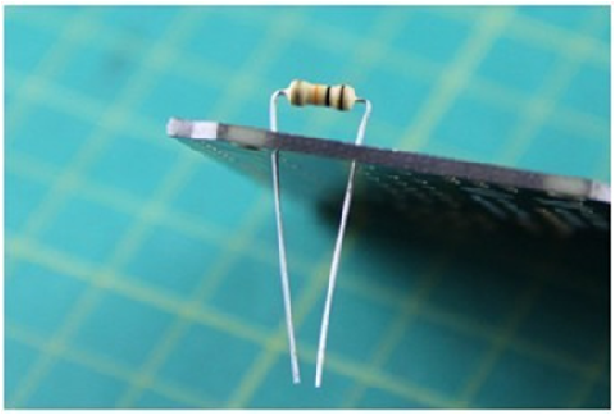
Component	Board Location(s)	Qty	Notes
Acrylic shell		1	Thickness:2mm
Standoff	Locating holes	3	Plastic, height: 15+6mm Diameter: 3mm
Screw		3	Plastic, diameter: 3mm
Nut		3	Plastic, diameter: 3mm

Soldering 1·2·3

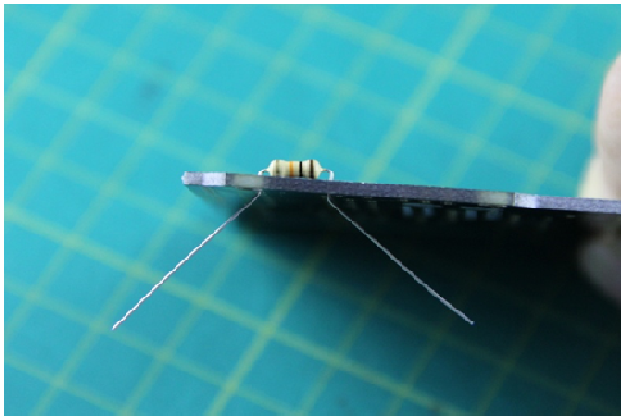
We will solder the components in the order they are listed in the Electronic Components section.

1. Resistors

Let's start with R3, a 10k resistor. First, insert it into its given location on the base board, marked R3.

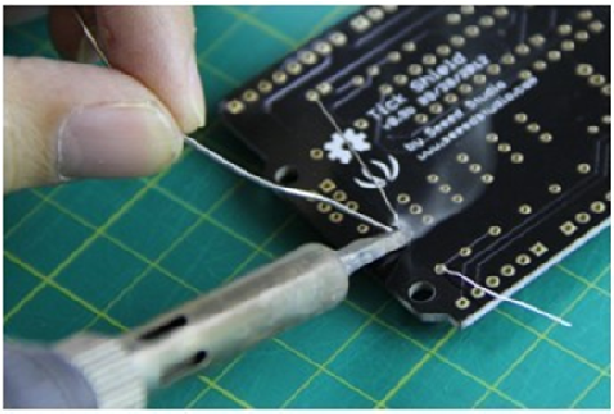


Bend its leads out so you can hold it in place when soldering.

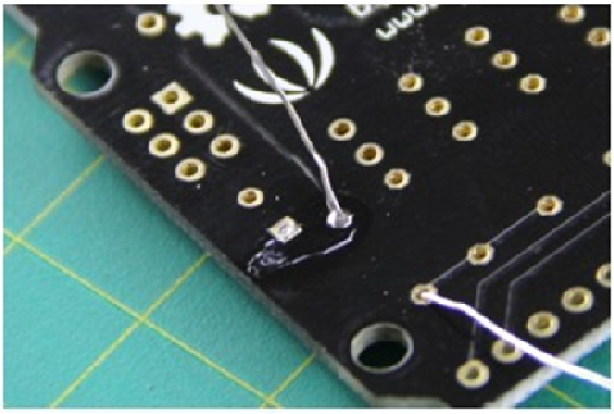


Flip over the board, and we can solder one lead at a time. Make sure the tip of your soldering iron is shiny. If not, melt some solder on it and quickly wipe it on the wet sponge.

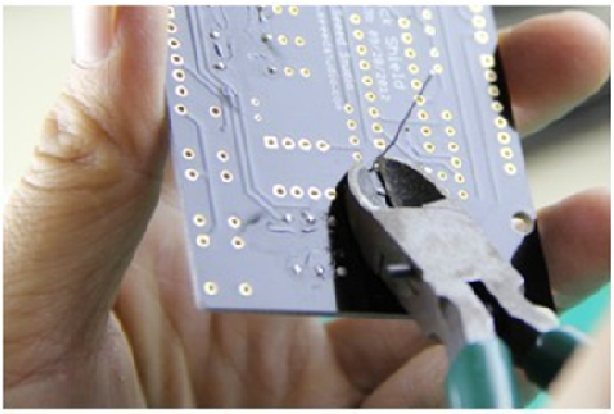
Place the solder against the lead you want to solder. Move the tip of soldering iron to the lead and melt the solder. The melted solder should instantly stick to the lead. If not, use the iron tip to draw it there. When finished, it should resemble a volcano in shape and have a shiny surface. If not, wait for the solder to cool and melt the solder again.



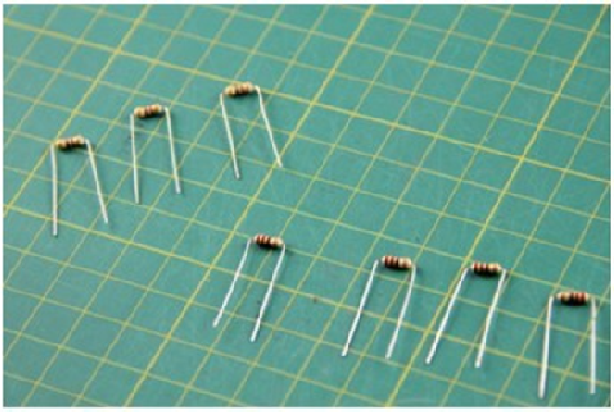
Congratulations! You've finished soldering your first pad!



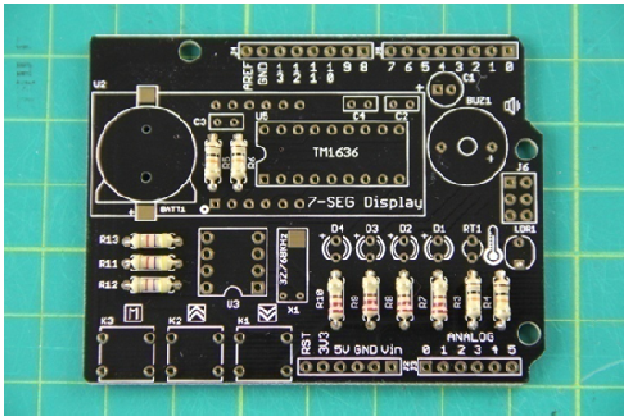
We don’t need the excess lead (the wire sticking out of the board). So when you’re done, use the flush cutter to cut the excess and make it flush with the board. Be very careful when doing this as the lead will fly off after cutting it. Turn the board to one side to prevent the lead from inadvertently injuring you. It is highly recommended that you wear eye protection during this step.



The directions above relay the basic technique for soldering. You can apply these steps when soldering the remaining components to the board.
Now solder the remaining R3 lead and the other resistors. Preform them into U shapes, as depicted below. This will speed up the soldering process.

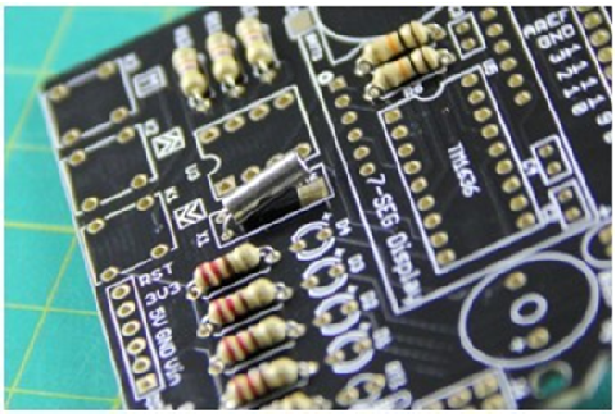


After you’ve completed the steps so far, the front of your Tick Tock Shield will look like the picture below.

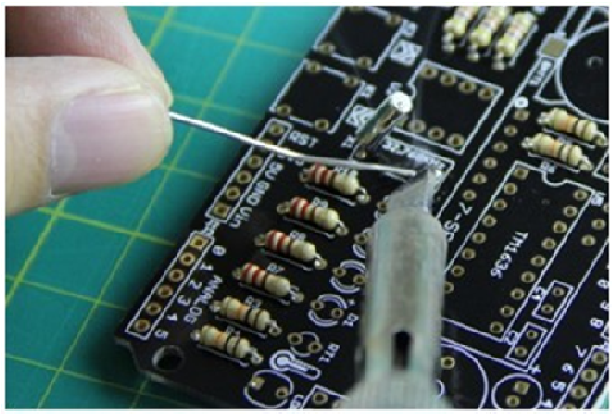


2. LEDs, Sensors & Crystal

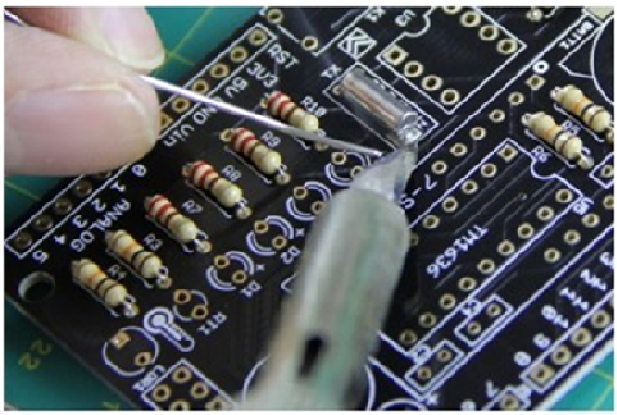
Insert the crystal into its location and bend it down until it's close to the board.



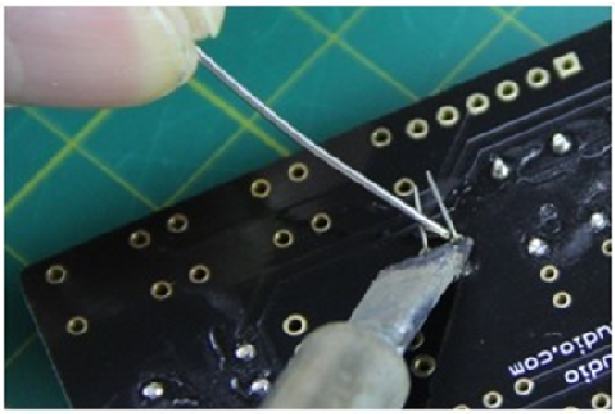
There is a square locating pad on the board that helps you keep the crystal flush. Melt some solder on the pad first.



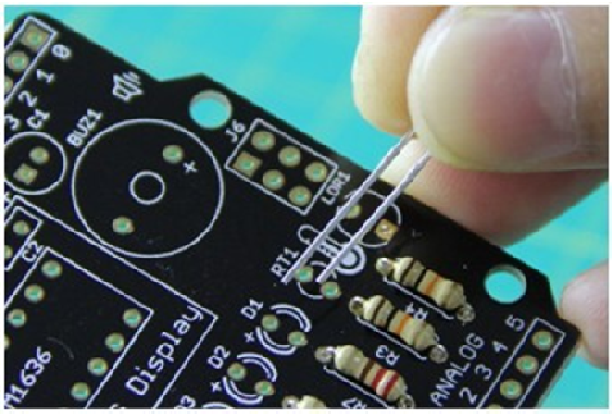
Now push down the crystal and add more solder to the locating pad. When cool, the crystal should stick to the pad.



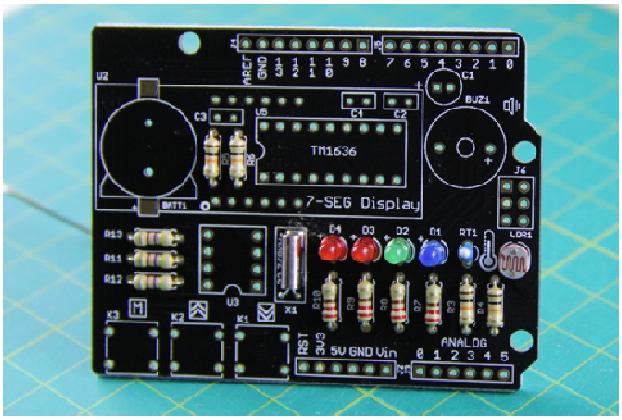
Now flip over the board and solder the crystal's two leads.
Clip of the extra leads just like we did with the resistors.



Remember the LEDs are polarized so make sure to insert them into their correct locations. The longer lead will go into hole marked "+", and place the shorter one in the other hole.

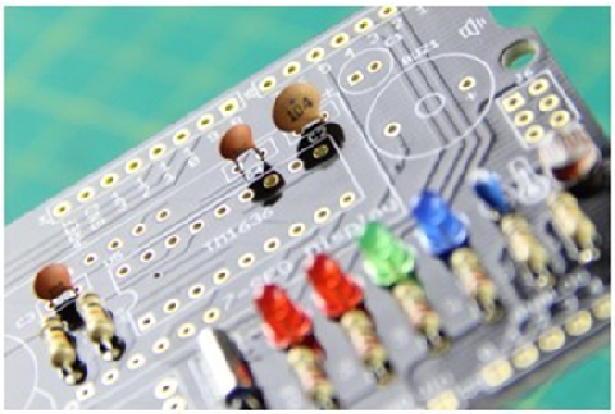


Just like the resistors, the thermistor and light dependent resistor are not polarized so it doesn't matter which way they are inserted, simply insert both leads into the board.

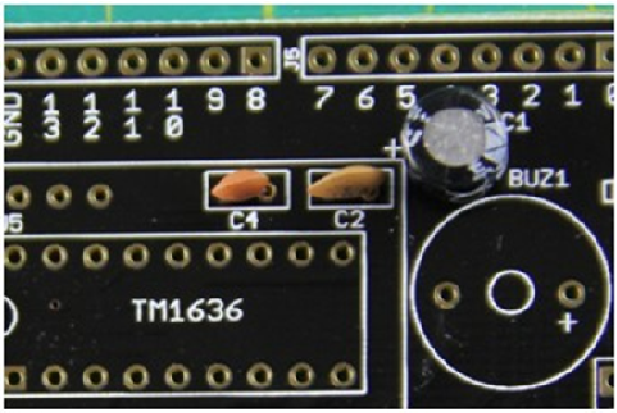


3. Capacitors

We have two different kinds of capacitors. The light yellow, disc-shaped capacitors should be inserted with the numbers displayed like this. They are not polarized.

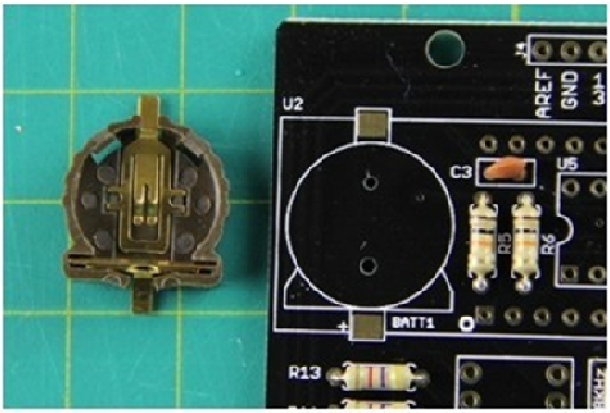


For the square black capacitor, make sure the longer lead goes in the hole marked with a “+”. This is very important as capacitors are polarized just like the LEDs.
Then solder them just like you did the other components.

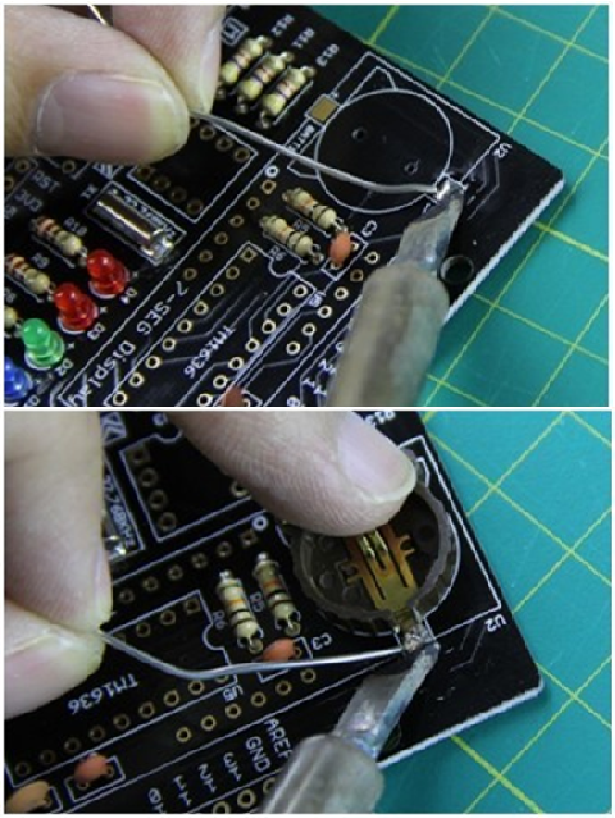


4. Coin Cell Holder & IC Sockets

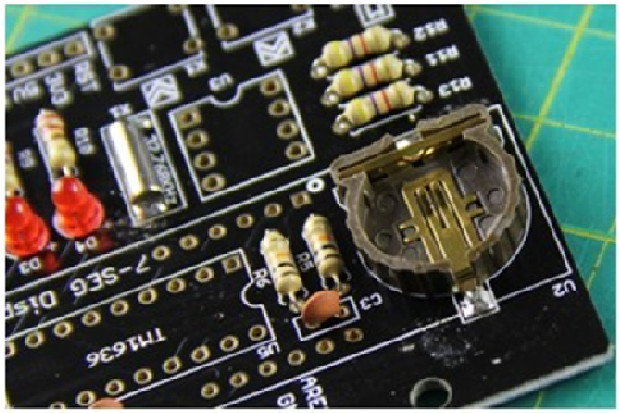
Place the coin cell holder on its printed image on the board.



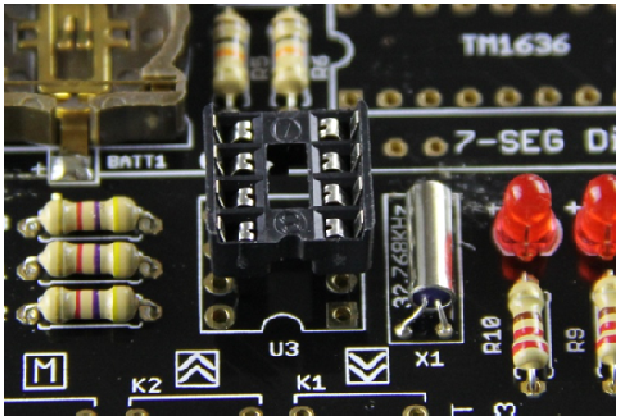
This is the only surface mount component in this kit. Surface mount just means the component is soldered onto the surface of the board as opposed to through hole like the other components. Soldering it is very similar to soldering the crystal to the pad.
First, melt some solder on its pads, and add some more solder to attach the holder to the board.



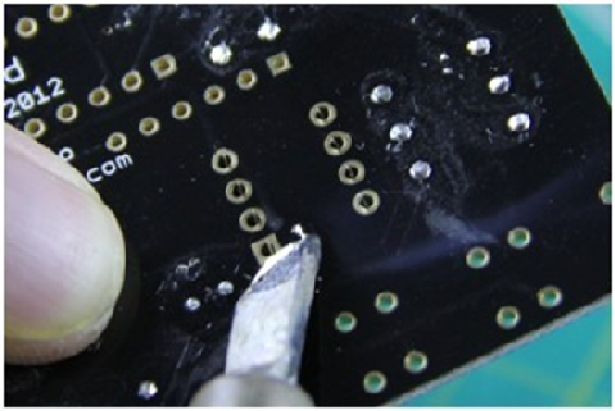
When you are done with the two pads, it should look like this:



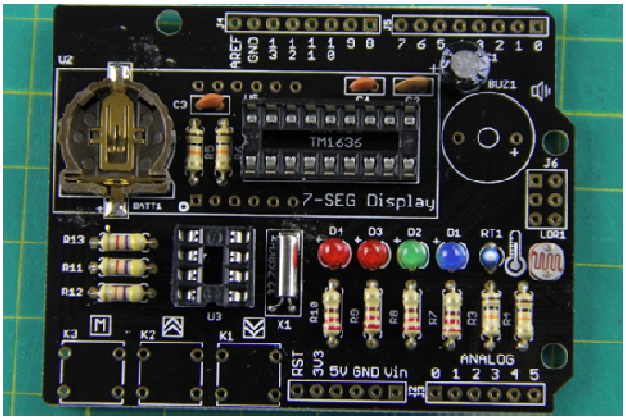
Now let's move on to the sockets. Search for the half-moon shape on the board. This is the directional indicator for the IC Sockets. It is very important that the orientation of the IC socket is correct.
After soldering the 4 LEDs and 2 sensors, the board should look like this:



There are eight legs for the U3 socket. Place your finger on the socket to keep it in place when you flip over the board. Quickly spread some solder onto one of the legs.

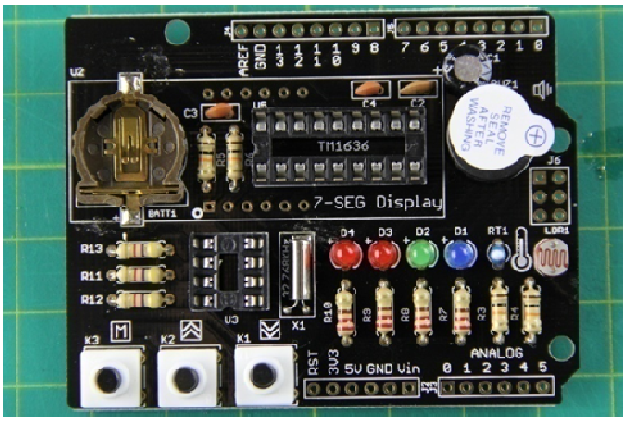


Now you can leisurely continue the soldering the other legs. Repeat these steps for the U5 socket also. Let's take a sanity check. Does your board look like the one below?

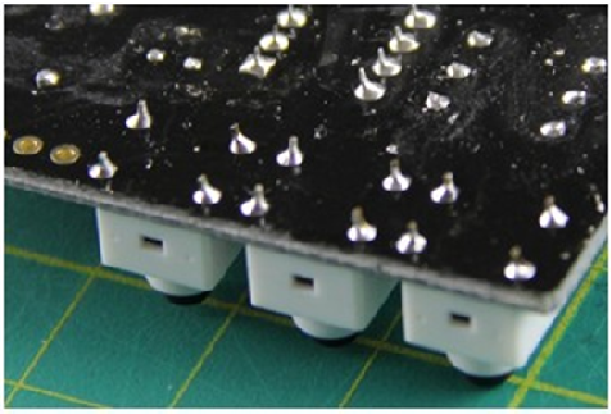


5. Buzzer & Buttons

Now it's time to solder the more advanced parts. Buzzers have longer and shorter legs just like LEDs. Insert the longer leg into the notch marked with the "+". As for the buttons, just snap them into their locations. You can't fail at this because they are rectangular. After that, the board should resemble the picture below.

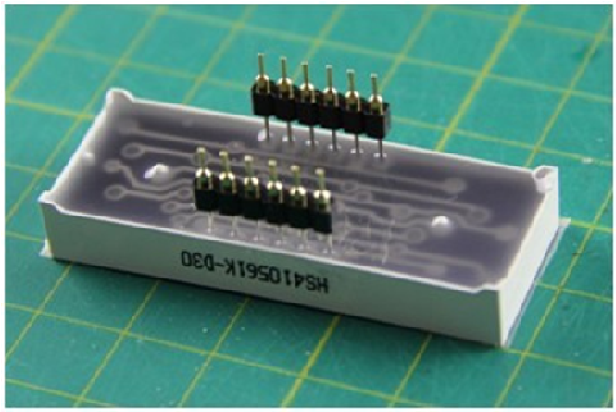


Now flip it over and finish soldering. Soldering should be second nature to you now. Notice again the desired volcano shaped solder points.



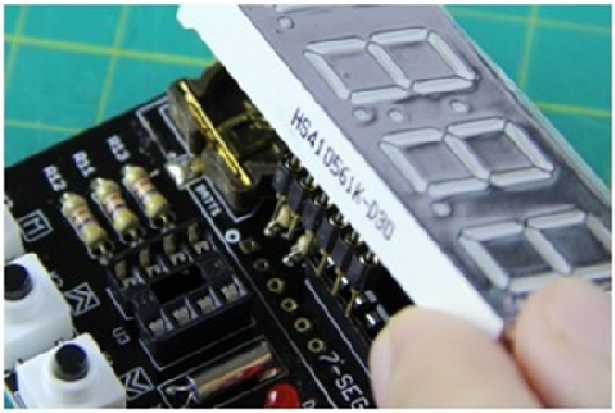
6. 7-Segment Display

Stack the female headers on the 7-segment display as shown.



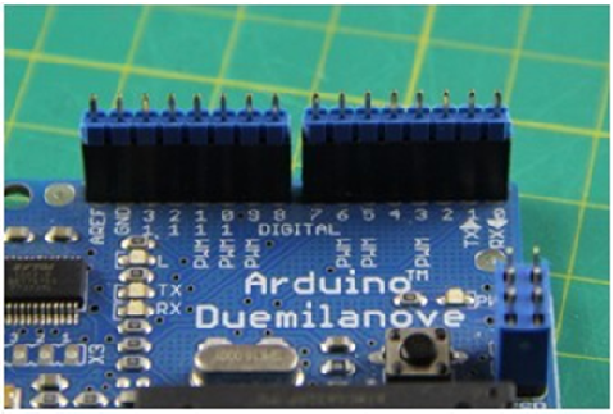
Now insert the 7-segmentdisplay onto the board. Match up the printed side of the 7-segment display with the solid circles on the board.

Flip over the board and solder the female headers just like you soldered the IC sockets. Anchor one leg first, and then solder the remaining legs.

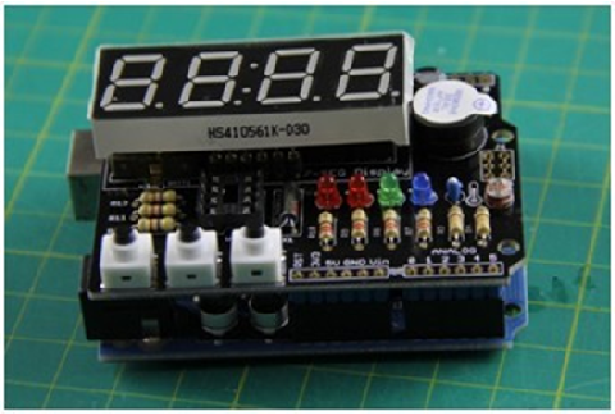


7. Stacking Headers & ISP Header

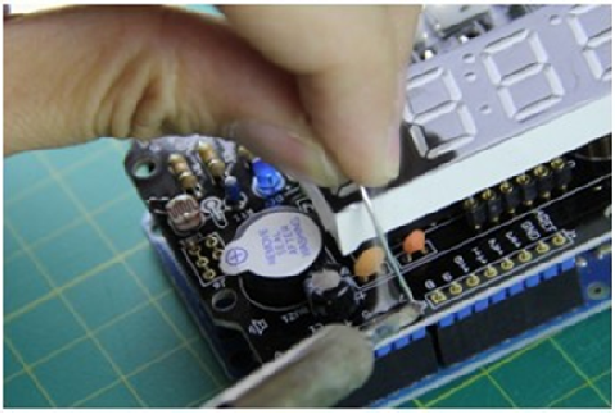
To keep the stacking headers vertically straight during soldering, we'll use the Arduino as a guide.



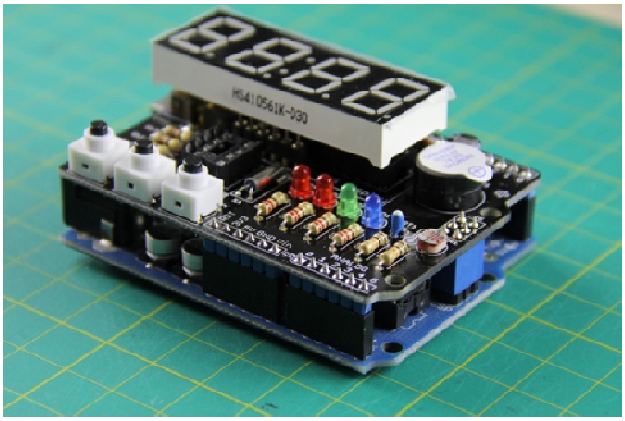
Insert all headers including the ISP header. Then stack the Tick Tock Shield on top.



Now solder from the top.

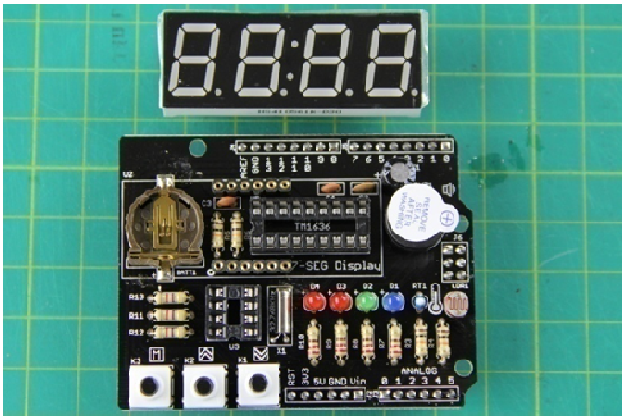


Alright! We are done soldering, now just a few more assembly steps. Feel free to turn off your soldering iron.

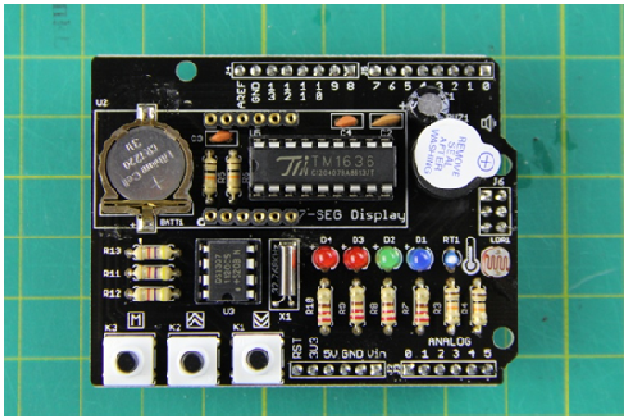


8. Chips & Battery

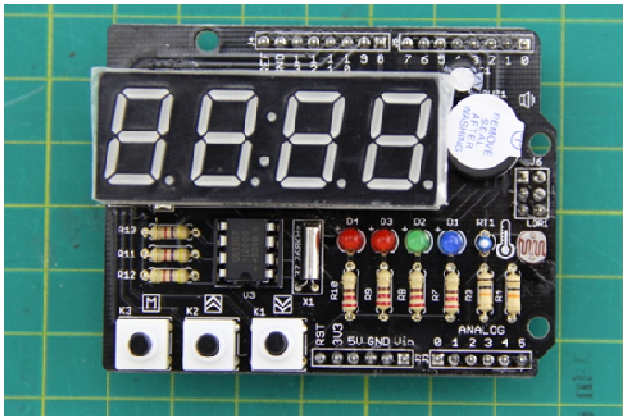
Now let's insert the battery and ICs. First, remove the 7-segment display.



Insert the U3, U4 and U5 chips into their locations by snapping them into the IC sockets. It's very important to align the chips per the half-moon shape on the chip to the half-moon shape on the board.

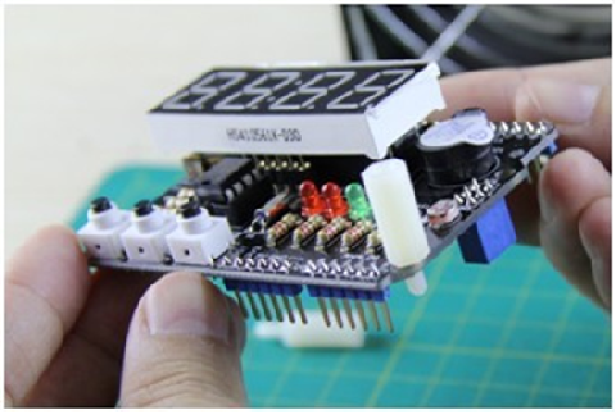


Now plug back in the 7-segment display.

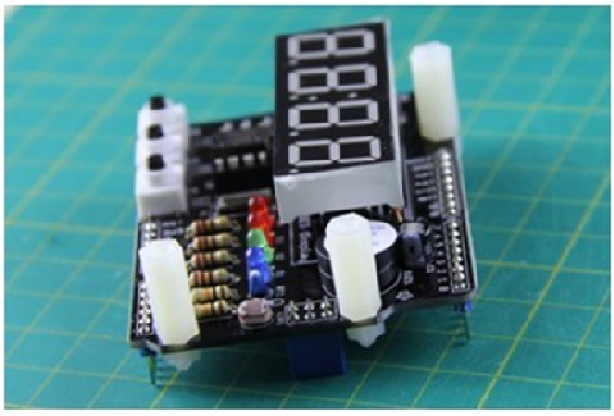


9. Acrylic Shell & Standoffs

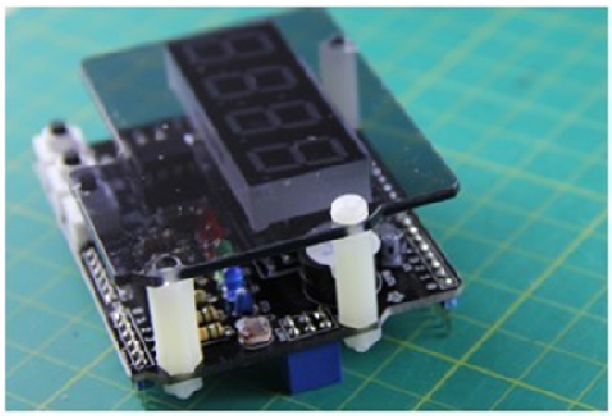
Place three standoffs in the large holes on the board.



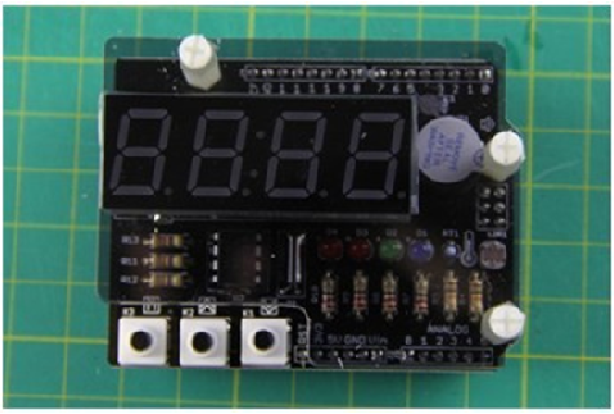
From below, secure the standoffs to the board, by screwing a nut onto each one.



Place the acrylic shell on top.



Tighten the standoffs with screws from the top.



Congratulations! Your Tick Tock Shield is now ready!

Now you just need to upload the Arduino code to be up and running with your new clock. We prepared a set of fun demos and a comprehensive program that turns Tick Tock Shield into a real time clock on its wiki page:

http://www.seeedstudio.com/wiki/Tick_Shield_Kit

Head there now to dive in the world of programming!