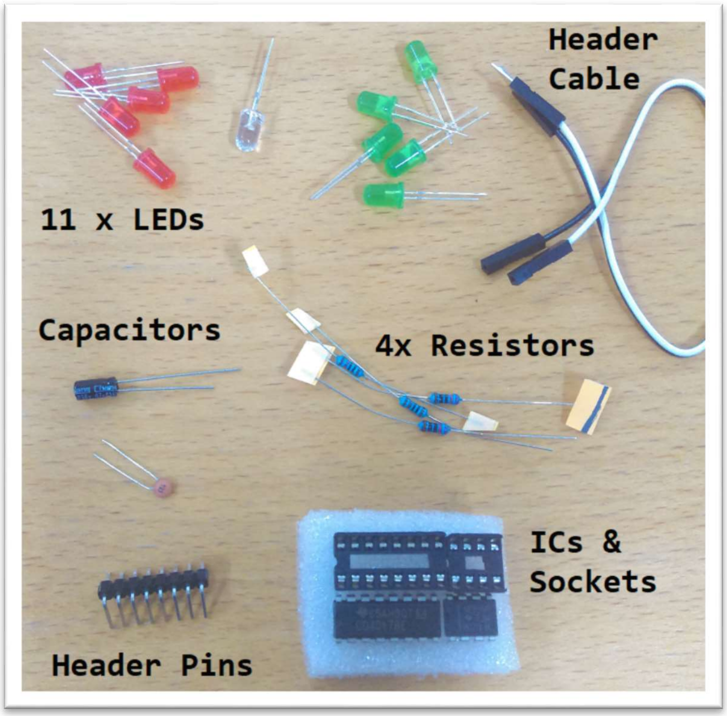
XC3754 Soldering Guide

Kit Contents

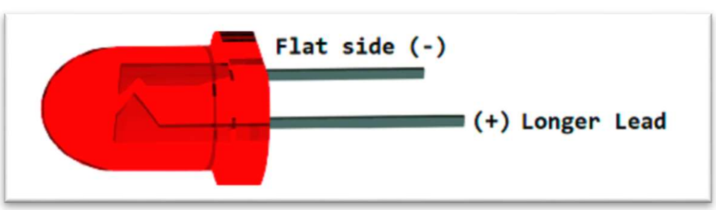
Open up the package and lay out the contents to ensure you have them all. You should have:

- 5 Green and 5 Red LEDs
- 1 Clear LED
- 4 Resistors (2×220Ω, 1×1kΩ, 1×10kΩ)
- 2 Capacitors (one ceramic, one electrolytic)
- 2 ICs (*integrated circuits, or "chips"*): 555 & 4017, and matching sockets
- Header pins, Header cable
- PCB board.



Preparing the LEDs

Start by placing one of the LEDs in the circular pads marked out on the PCB board. You will notice that the circular markings (called the *silkscreen*) have a flat section, this marks the **negative** lead of the LED. You will be able to feel a similar flat section on the base of the LED with your fingers. You can also notice that one of the LED legs is longer than the other, which marks the **positive.**



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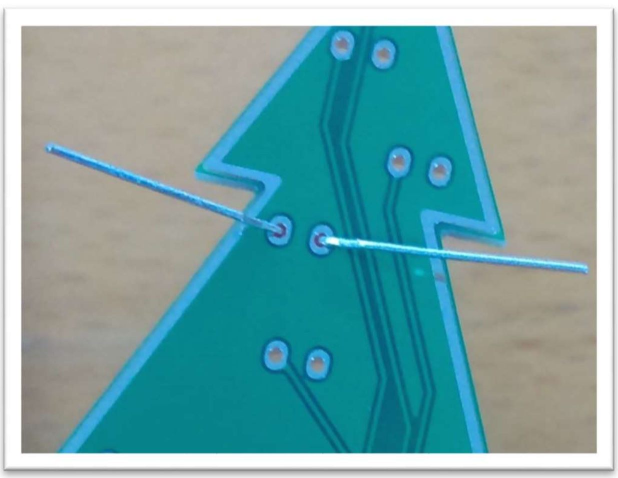
Place the LED into the marked section so that the longer lead is in the hole *away* from the flat marked section.

Then bend the legs of the LED so that the legs hold the LED into place and it can't drop out or wiggle around too much.



Once that is done, you will want to snip the legs of the LED much shorter. We do this so that the heat from the soldering iron is not wasted heating up the whole leg, only the small section close to where we want to solder

Get your iron ready

If you are using a temperature controlled iron, you want to set the temperature at about 350° C. It's important to have a nice clean and tinned tip, shown below.

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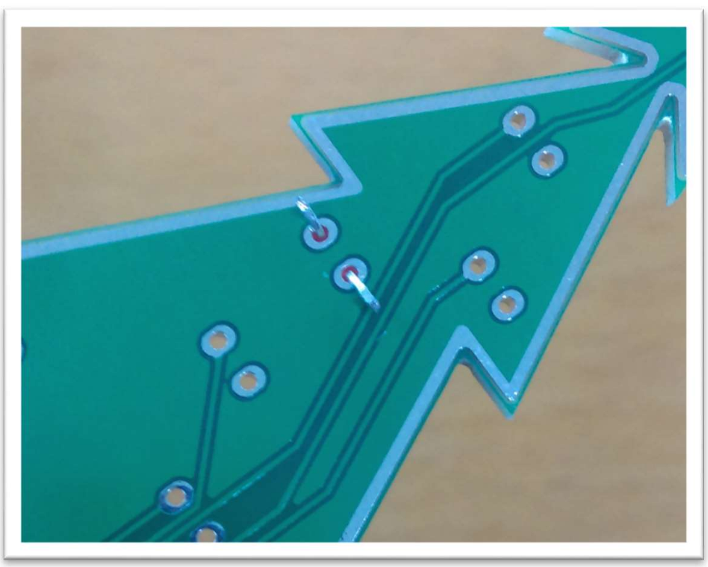
When preparing the iron, and it is sufficiently hot enough to melt solder, you want to touch the solder onto the iron itself, so that the solder and flux *(a component of the solder responsible for keeping the joint clean and flowy)* cleans any rust or dirt off the tip of the iron.

When the solder is on the iron, you need to remove it so you are left with a simple clean and shiny soldering iron tip.

You can either **wipe** onto a damp sponge or rag, or **stab** into some copper scourers to remove the solder. Once it has been tinned, you can often just clean the tip while you're soldering to keep it in good order *(do not use plastic sponges, as they will melt. A sponge like what's on the TS1502 will do, or pictured: our soldering tip cleaner TS1510, which comes with two scourers and will last for a few years, we use this almost daily.)*



Once the legs are snipped, you can apply some solder to the joint. Read on in the next section for how.

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How to solder correctly

One of the main important notes about soldering is the need for the components to be the correct temperature for the solder to bind to them, in this case it is both the PCB pads and the LED legs.

A good way to do this is to use the iron from one direction and apply the solder from the other direction, making sure that the solder touches the components and melts through the heat of the components, rather than touching the iron.

Here, you can see we have the PCB mounted in our “Third Hand” holder, TH1982. We apply the soldering iron to one side of the LED leg, touching both the leg and the pad underneath.

Then we apply solder from the top, so that the heat of the leg and pad is what melts the solder. Once the solder flows, it will touch the iron to help keep everything hot and flow well into the joint.

You only want to apply the heat to the components for a few seconds, it’s best to try to aim for under 2 seconds. You can re-touch the joint if needed, but do not hold the heat on the components too long as it can damage whatever you are trying to solder, including the PCB itself.

It can take a bit of practise to get the timing right, but that’s what this kit is all about.

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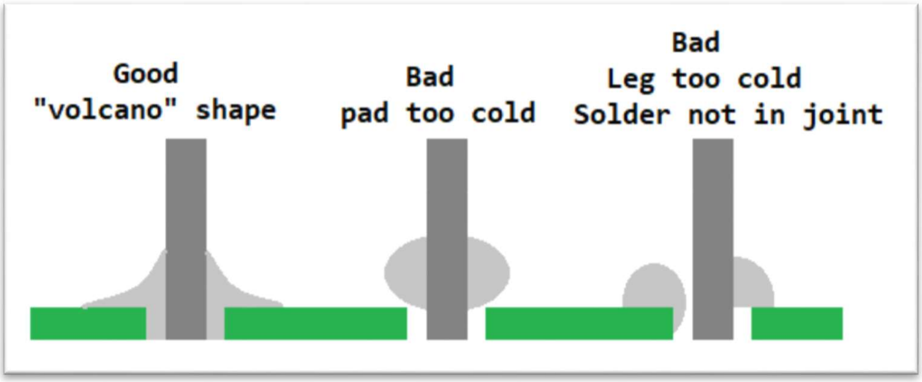
It's important to make sure that the solder joint is good while you make them, as they can be difficult to track down once you have built the circuit and you're trying to find a reason it doesn't work as expected. Below are 3 types of solder joints; what you're looking for is a nice "volcano" shape, with the solder concaved inwards, rather than bubbling outwards. It should also appear fairly shiny if it's a good clean joint.



Once you have done one LED, congratulations! Trim the legs a little neater if you want. You can have a go of trying the other LEDs, remembering what we've discussed:

- The longer leg must fit in the hole away from the flat marking.
- Bend the leads so that the LED doesn't move.
- Snip the leas so the heat is close to the joint (and not heating the whole leg)
- Apply Iron from one side, solder from the other
- Aim to heat for 2 seconds max. (count while you're heating)
- Shiny volcano shape. Re-touch if needed but try not to touch too much.

If you find that you can't get a shiny joint, you might have to clean any pads and legs you're soldering, and get some fresh solder. Most, if not all solder should have some amount of flux in it, which helps remove dirt from the joint and give it that shiny look via a protective flux cover. We also sell flux pens (NS3036) which can help if you're soldering some older or dirtier electronics, but you won't need it in this kit.

Once you've done the one, you can follow through and do the rest of them in an alternative fashion as shown to the right.

Next up we'll do the resistors.

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Soldering the resistors

You will find 4 resistors in this kit, 2 of them are together on the same tag (220 ohms) which correspond to **R3** and **R4** on the PCB board.

You can check what value they are by the resistor colour codes: for 220 ohms, you should find *red-red-black-black-brown*, which is a 5-band colour code.

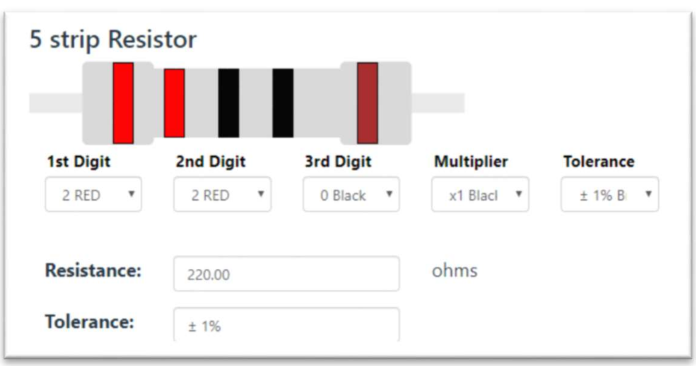
Each of these colours stand for a number, which corresponds to the resistor chart. It's easy enough to remember as a rainbow that starts with black, brown, then goes through red to violet, then grey and white (*which are rarely used*).

With a 5 band colour code, bands 1-3 are digits, then the 4th is a multiplier (such as "1000". The 5th band is usually separated away from the other bands so you know which way the resistor is orientated, and just means tolerance, or how precise it is.

See if you can figure out how to read the 220-ohm resistor bands

Colour	*Digit*	*Multiplier*
Black	0	×1
Brown	1	×10
Red	2	×100
Orange	3	×1000
Yellow	4	×10 k
Green	5	×100 k
Blue	6	×1 M
Violet	7	×10 M
Grey	8	×100 M
White	9	×1 G (for Giga-ohms)

If you get stuck, there's plenty of online calculators to try out. 4 band resistors simply have two digits, along with the multiplier and tolerance.



Once you've got one of the two, 220Ω resistors, use a pair of pliers to bend the legs to a straight 90° angle, close to the body, as shown below.

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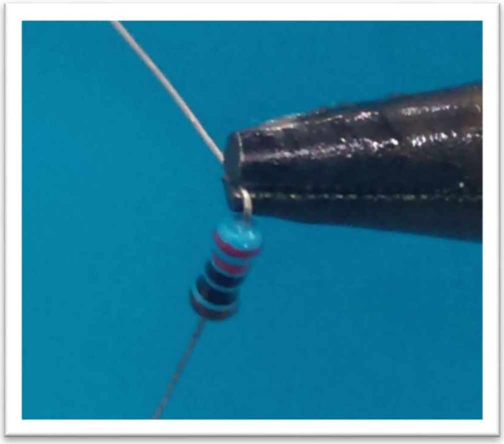
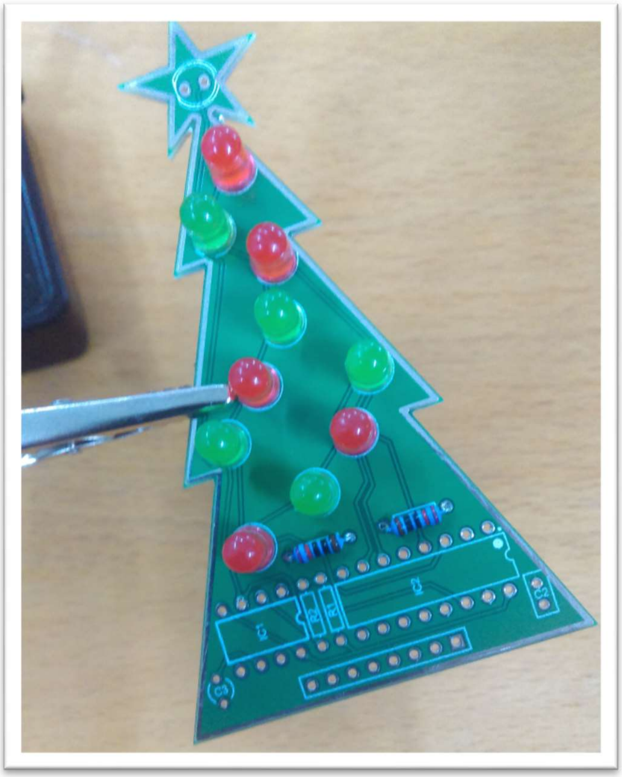


We do this as a stress relief for the resistor and is good practice to get in to. Bending it before placing it into the PCB means that the joint will not be under stress once it is soldered in. Having stress on the joint can break the joint in a way which is impossible to see by the naked eye, called a *hairline fracture,* and can be a huge source of trouble to track down when the circuit is not working correctly. It will also look neater in the project, which is what we want when making a Christmas tree display.

Bend both legs of both resistors to 90° and place into R3 and R4 on the PCB board, as shown.



Similar to the LEDs: bend the legs so that they don't move, then snip them down to size. Heat from one side and apply solder from the other side, for each joint on the underside of the PCB.

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For the other two resistors, your band-colour recognition is put to the test, *(don't worry, you can use a multimeter or an online calculator to check if you are not sure).*

For **R1** you want to use the 10kΩ resistor, which should be:

brown-black-black-red-brown = 1 0 0, ×100, 1% tolerance. (100 × 100 = 10,000 or 10k).

Bend and put this resistor in place on the PCB board. **R1** is found next to the large **IC2** on the PCB.

For **R2** you want to use the 1kΩ resistor, which should be:

brown-black-black-brown-brown = 1 0 0, ×10, 1% tolerance. (100 × 10 = 1000 or 1k).

and this is found right next to **R1**, closer to the **IC1** side.

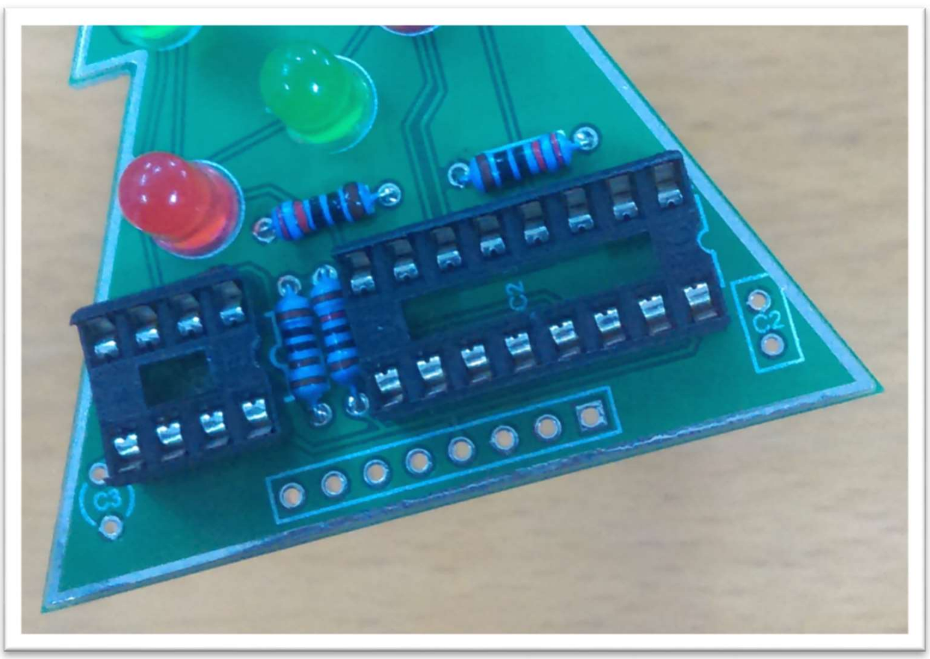
Once they are in place, snip and solder the resistors, like everything else.

Solder the IC sockets

Once the resistors are in, we'll do the IC sockets. It should be pretty obvious where these go, but they do have an orientation to them.

It is not critically important that you get the IC *sockets* facing the correct way, however it *is important* that you get the IC chips in the correct way. For that reason, we'll make sure that the IC sockets are facing the correct way so we can match our chips to the socket, instead of trying to look under the part we've soldered at the picture.

Place them on the board as shown. Notice that there is a small notch cut out from the top of both of the sockets which corresponds to the notch on the image in the silkscreen. Make sure these match up, then you can simply bend one pin on each corner of the socket so that they don't move when you flip the board over to solder them in.



There's no snipping involved in this one.

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This should be an easy soldering job, as the flat tabs of the IC sockets absorb heat very well, so try to rotate the project so the iron comes from the top of the board and touches the entire pad and socket tab at the same time.

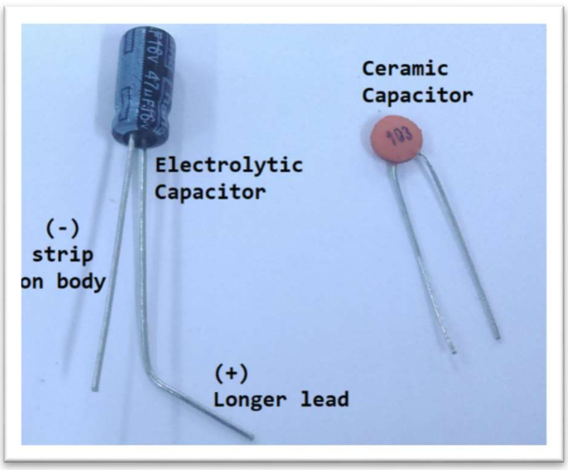
You should see that the tab gets hot almost immediately. Don't hold the heat too long, because IC sockets are notorious for melting quickly, and it can become a bit of a mess. 2 seconds max, but these are great to practise on so see how fast you can do a whole row of them. They don't always follow that volcano shape, so if the solder is not going *into* the joint too much, don't worry.

Solder all tabs in for both sockets.

Capacitors

The capacitors are the easier components to solder, and there's only two of them.

The little one is a ceramic capacitor and can go in either way. The larger black capacitor is an electrolytic, and has a polarity similar to an LED. You will notice that this too has a longer lead indicating positive, and a marked strip indicating negative.



The ceramic goes into **C2** on the PCB board, which is next to the larger **IC2** socket. The electrolytic goes into **C3** which is next to the smaller **IC1**. If you asked "which way?" then congratulations, you're catching on. The supplied installation notes mention:

"Capacitor (C3) must be installed with the negative side down & short leg in the lower hole."

Bend, snip, and solder in place.

Connecting the header pins

The header pins can be a little strange to work with, as they are too thick and strong to try to bend once they are in position. However, you can use the alligator clip from the third hand tool (or whatever tool you're using to hold the PCB in place) to grab both the PCB and the header pins, while you dab just one connection on.

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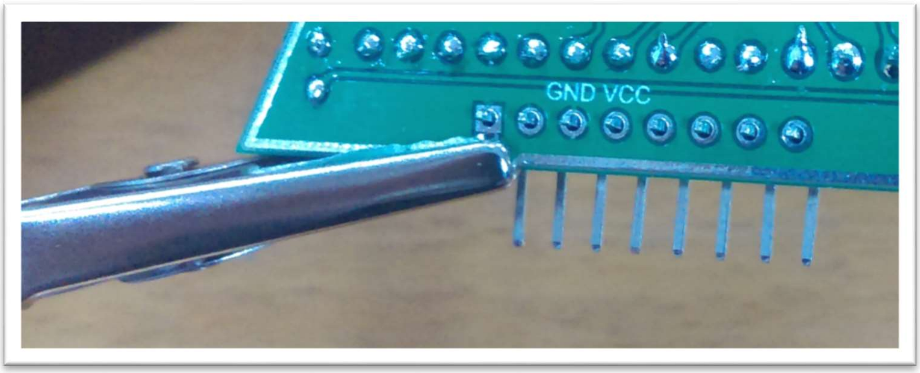
The header pins fit on the PCB board with the short side of the plastic going through the PCB holes, and the longer legs are on the same side as every other component.



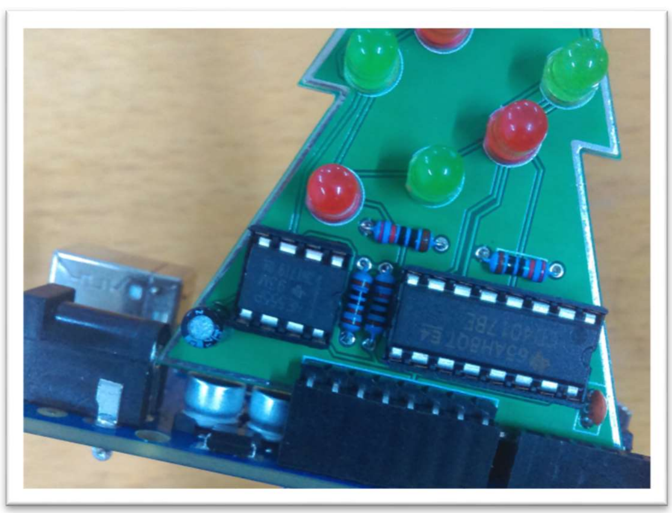
Here, we'll hold it from the left, and solder the right most connection, just to hold it in place. Make sure that the alligator clip is not bending the component or putting it in an awkward position; this too can take a bit of practise.

Once the rightmost connector is a good solid joint, you should find that the header pins should not move too much. If you find that the header bends outwards (*away from the PCB*) when you remove the clip, put it back in and touch up the joint again, this is an example of stress on the component. Touching it up once or twice should do the job and adjust the component so that it lays flat on the PCB.

Once the pins are held into position, adjust the alligator clip so you can solder all of them, and work your way from right to left. Making sure they are all good connections.

Finishing up

Once the header pins are in, you have every component on the board. The legs of the ICs are often too wide for the IC sockets, but you can very gently bend them into shape so that the IC slides into the socket. **Make sure** that the ICs are facing the right way by looking at the notches on the ICs. Some ICs might also have a dot on top corner of the chip which indicates the same thing.



Once everything is in place. Attach to the power connections header on your Arduino and power it up, you should see it come and sparkle to life.

Merry Christmas!

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