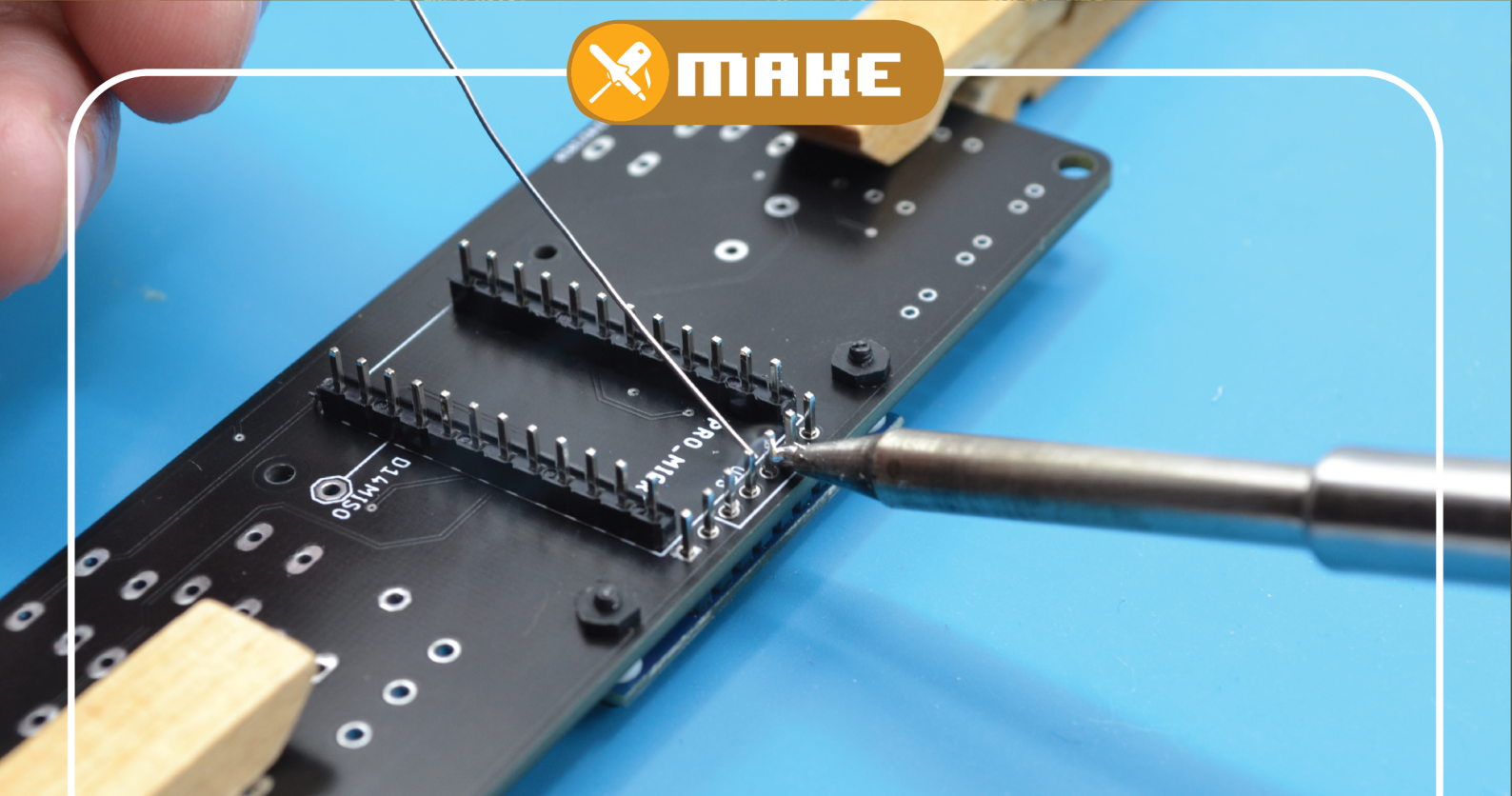




MAKE



Soldering Basics

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Soldering Guide

This soldering guide is brought to you by 8BitCADE. This is a section from the 8BitCADE console MAKE guides, if you like the content in this tutorial, be sure to check out 8bitcade.com for more tutorials and the 8BitCADE consoles that go with them.

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Version 1

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Soldering 101



This tutorial aims to teach you the basics of soldering, how to solder and how to identify and fix bad solder joints. Lets get started

What is Soldering?

Soldering is used to bond two pieces of metal together using a filler metal. Welding might come to mind however welding is where you melt the work pieces together, here we use something called solder (the filler material) to bond the work pieces together. Firstly, we melt the solder, allowing it to flow between the workpieces and cool to create a bond. In our project, the work pieces are the PCB and components. We are going to be doing "through hole soldering". Before you start, [check out this video here](https://www.youtube.com/watch?v=QKbJxytERvg)

<https://www.youtube.com/watch?v=QKbJxytERvg>

So What Tools Will We Be Using?



Soldering Iron

A soldering iron will be the heat source; it is used to heat up the solder. You don't need any fancy kit, a soldering iron that can reach temperatures between 300 to 400 degree Celsius. The one that we use and recommend can be found on the [8BitCADE store](#) and is a great 80W, temperature adjustable soldering iron. We recommend an iron that can be adjusted as it allows for greater versatility and safety when soldering components such as IC chips that are heat sensitive – this one has a brilliant LCD screen built in that allows you to see and adjust the temperature.

<https://8bitcade.com/shopfront>



Solder

We advise solder that has a ratio of 60/40. This means that it is made up of 60% tin and 40% lead. Low quality solder can cause bad solder joints and endless amounts of frustration – get good solder! The one that we recommend can be purchased at the [8BitCADE Store](#). Its 60/40 and 0.5mm in diameter, forcing you to be conservative with your soldering!

<https://8bitcade.com/shopfront>



Solder Cleaner

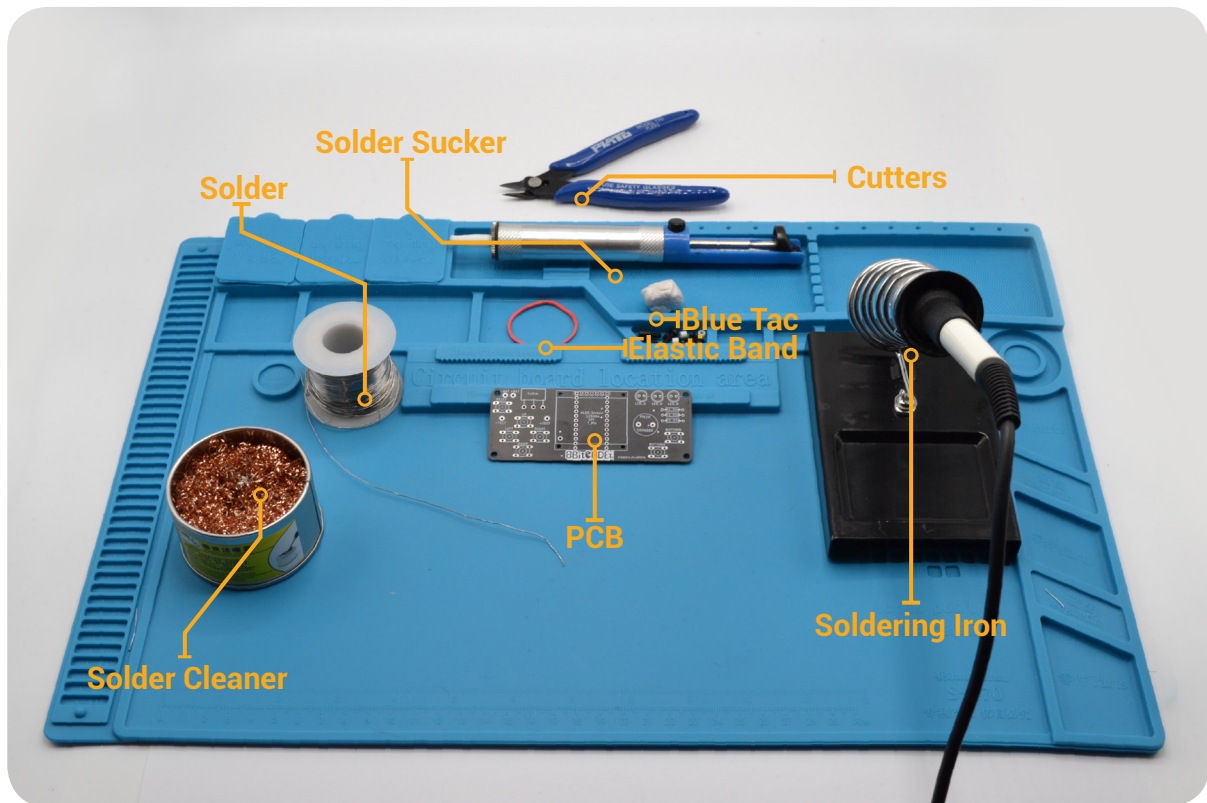
This is used to clean the tip of your solder from both excess solder, flux and any oxidation that might have occurred on the tip. The one we use and recommend can be purchase at the [8BitCADE store](#).

<https://8bitcade.com/shopfront>

Solder Safety

- Do not touch the end of the soldering iron while it is on/cooling down – they are very hot!
- After soldering a joint, DO NOT touch the joint as it will still be hot.
- Soldering does produce fumes, and for most can be nauseating if directly inhaled over long solder periods. We advise you to take 5 minute breaks every 25 minutes of soldering and to solder in a well ventilated area. DO NOT breathe in the fumes directly – a fan or ventilator can help remove fumes or simply moving your head to the side, not directly above.
- NEVER place your solder on the workstation, ALWAYS place it in the soldering stand/station.

Soldering Station



Understanding Your Work Station

While we have broken down each core tool we will be using, for those that want to get into soldering, we recommend the setup like above. A polymer mat helps stop burning solder from marking your table and also organizes your work station. We can also see we have some basic tools to help secure our work piece, such as elastic bands and Blue Tac - see more below.

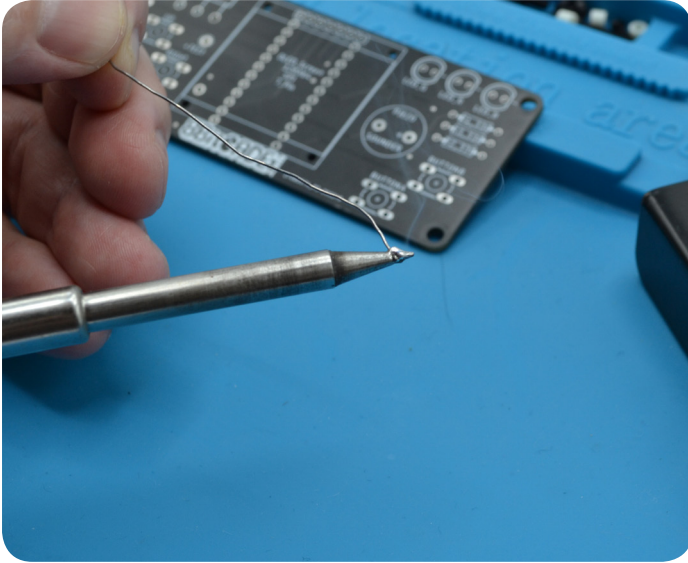


Holding the Work Piece

For those starting out with soldering, and don't have a "helping-hand" station, then we advise you grab some of your mums pegs and peg your work piece! It raises the PCB up enough for the work piece to be secure, flat and for the components underneath to not be touched. On the contrary, for those who are looking to solder more often, we advise investing in a "helping-hand" station that securely holds your work piece using crocodile clips.

Before We Begin

Read this section before you start making!



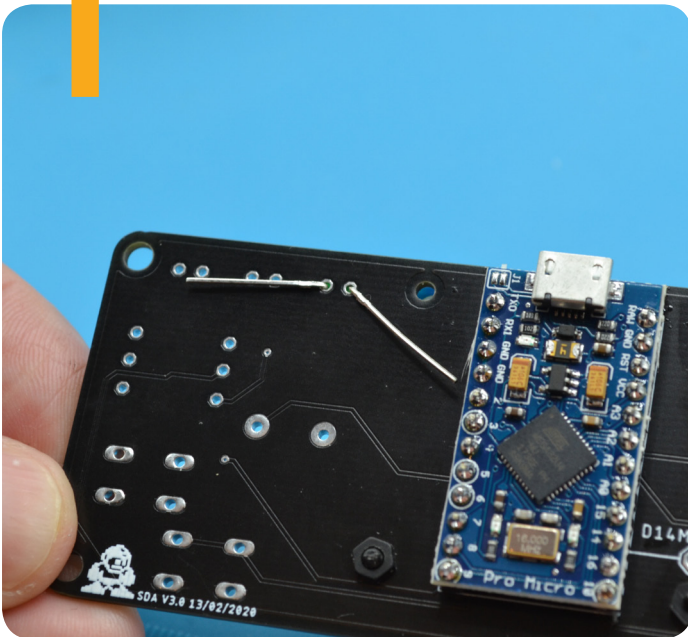
Tinning The Tip

What does “tinning the tip” mean? To put it simply, its covering the solder tip with solder. We can use this before we start soldering and when we are finished. Before packing away your soldering iron, you should tin the tip to increase the life of the tip. The tip of your soldering iron oxidizes quickly, as it is typically made out of copper plated with iron. By melting solder around the tip, we are stopping the tip from oxidizing (as an oxidized tip is inefficient at transferring heat). However another use for tinning the tip is before you solder a fresh joint. By having a bit of solder on the tip, you can spot-solder the joint as the solder from the tip cools and fixed the joint in place while you heat up the joint. It also aids to the efficiency of transferring heat from the tip to the joint.

Soldering Components to a PCB

Known as “through hole component soldering” it will be the main soldering we use in this build guide. This is a tedious job because we are dealing with heat sensitive components. Its crucial to not over heat the parts/pads. But do not worry! We will take you, step by step, through the process and you’ll be a soldering genius in no time – remember, you can always desolder! And you’ll learn that too!

1

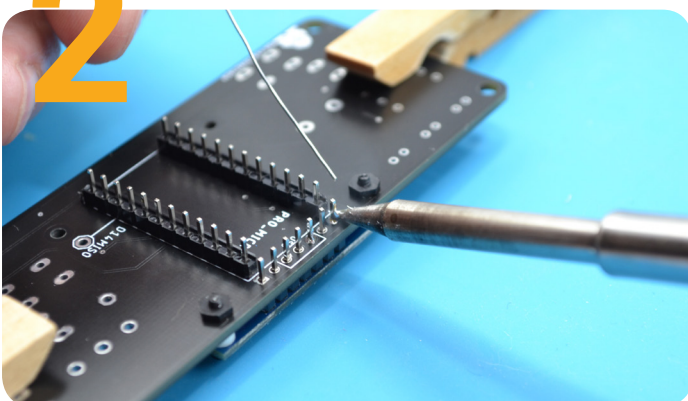


Mount Component

Check with the guide photos while doing this as you don’t want to be soldering and Desoldering a part because you put it in the wrong way around! For components like resistors, you can slightly bend the legs out, allowing you to flip the PCB around and solder the joint. For other components, masking tape can be used to hold the component in place. For more advanced uses, a “helping hand” can be used. These units utilize crocodile clips, on arms, to hold the PCB and component in place – it’s up to you how you want to approach this but blue tac and masking tape can go a long way!

Top Tip: Before soldering, ensure your work pieces are secure and wont shift mid solder - that can extremely frustrating. Major takeaway? Utilize masking tape and blue tac!

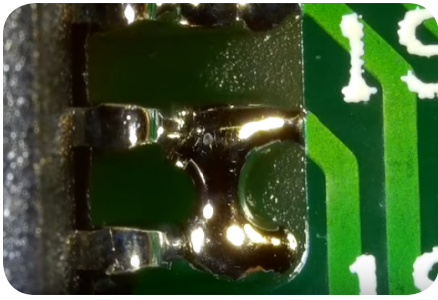
2



Heat The Joint

Apply heat on the component leg and conductor pad. The aim is for the pad and component to melt the solder, not the soldering iron tip. This ensures you do not get a “cold” joint (see reference picture below).

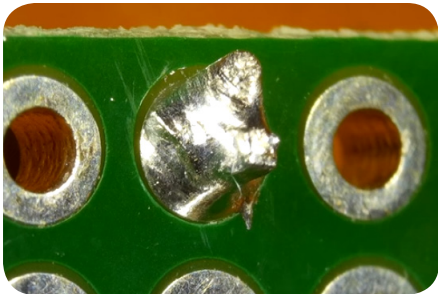
Check. Check. Check! Its crucial to check your joints. When soldering, you can run into a field of issues that can be easily fixed. Below is some of the most common mistakes and how to fix them!



Source: Pimoroni, Youtube-Androkavo

Bridging

When soldering joints that are very close to each other, the solder can sometimes flow and melt together. This can cause a short circuit and damage your board. Its important to check for any "solder bridges". Simply drag the tin down the middle, like a knife, to melt the solder and remove it. Sometimes this isn't enough and using a "solder sucker" can be a easy way to remove the excess solder. That's why this problem occurred in the first place, because of too much solder.

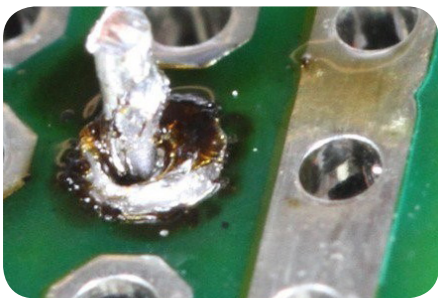


Source: Androkavo Youtube

Cold Joints

Is where the solder cooled too quickly and didn't get enough time to seep into the joint crevices. These generally look lumpy and rough with their strength being unreliable. If you get a cold joint, simply reheat the joint allowing the solder to flow better. Another reason for getting a cold joint is using too much solder, the excess solder can be drawn out by your tip or sucked out using a "solder sucker" that we will discuss later on.

Top Tip for Cold Joints: When reheating the joint, put some solder onto your tip. As the solder has cooled down, it has oxidized on the joint and can be harder to heat up. Adding solder onto your tip can help reduce this problem.



Source: Pimoroni, Youtube-Androkavo

Overheated Joints

Not enough heat? Well don't over heat it! This can cause issues as well. Not only will the heat get conducted up into the component and potentially damage the component, it can also damage the pad on the PCB – usually seen through black burnt marks and/or an orange tint on the solder. To prevent this, use a clean tinned tip with the correct heat settings (350 degrees Celsius).



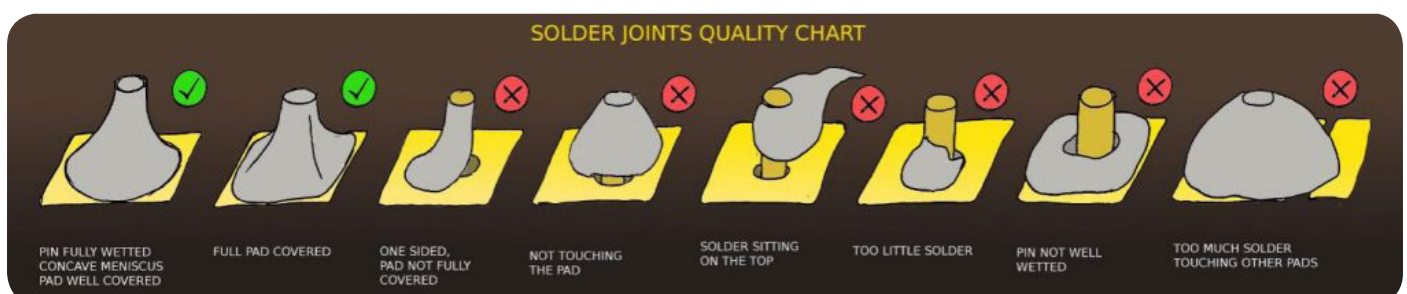
Source: SeedStudio - Soldering Problems

Insufficient Wetting

A term commonly used in reference to soldering. It is to do with how well the solder melts/bonds to something, e.g. the pads on the PCB. For us we are concerned with the solder properly wetting (being bonded to) the pads and legs of components. A joint that has insufficient wetting would be seen as the solder won't 'stick' to it. To solve this, resolder the joint with more solder, ensuring to heat the part that the solder didn't bond to.

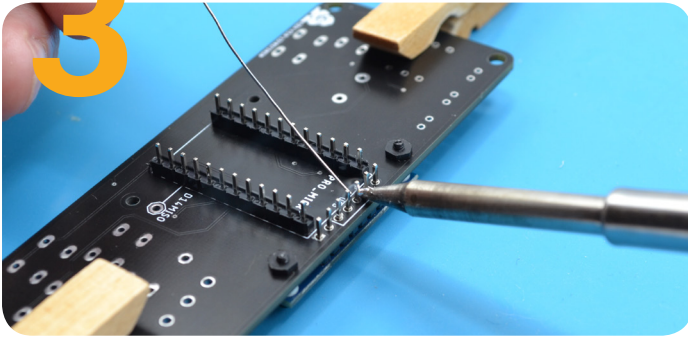
Wetting could be seen as using too little solder – but you can also use too much! The perfect solder joint is one that arcs up into the pin from the PCB, as shown in the photo. The aim is to make it look almost like a volcano – with the pin erupting from the middle.

Top Tips: You should be heating each joint for about 2 to 3 seconds and then applying the solder. A Temperature of 350 degrees on your soldering iron is recommend as too much heat applied can cause the component to be damaged.



Source: gaudi.ch

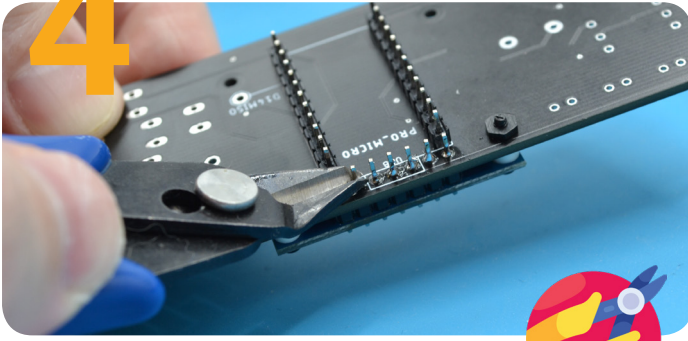
3



Apply Solder To Joint

Dip the solder between the component leg and pad, allowing the joint to melt the solder and fill the crack. If it does not then the temperature is not right, there are three general reasons for this: You soldered too early; The soldering iron temperature is too low and should be turned up or the soldering tip is not transferring heat effectively, meaning the tip could be corroded and/or too small for the joint.

4



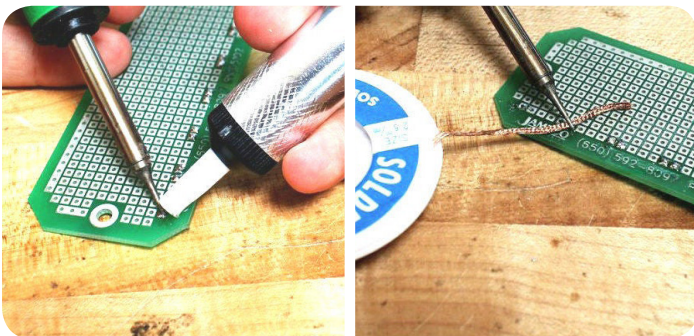
Snip Protruding Material

When trimming the legs of components like resistors, as a health safety rule, you should either hold the part being cut off, or cover it with your hand. This is as when you cut it, the pin will fly off and could land in your eye. To trim the legs, simply put the flat side of your cutters on the top of the solder and squeeze (covering it with your hand!).



Summary Tips:

- Do not heat the component for too long – as this could damage the component/pad
- Tin the Soldering iron tip beforehand to remove oxidization and make it easier to solder.
- The perfect solder joint is one that is shiny and looks like a volcano (a cone shape a concaved surface)



Source: printeraction Instructable

Desoldering

To desolder a part, we can use a solder sucker to quite literally suck melted solder from the joint, or we can use Desoldering braid/wick. Desoldering braid/wick is braided copper wire that will remove the solder from your joint by 'absorbing' the solder.



LET'S GET MAKING