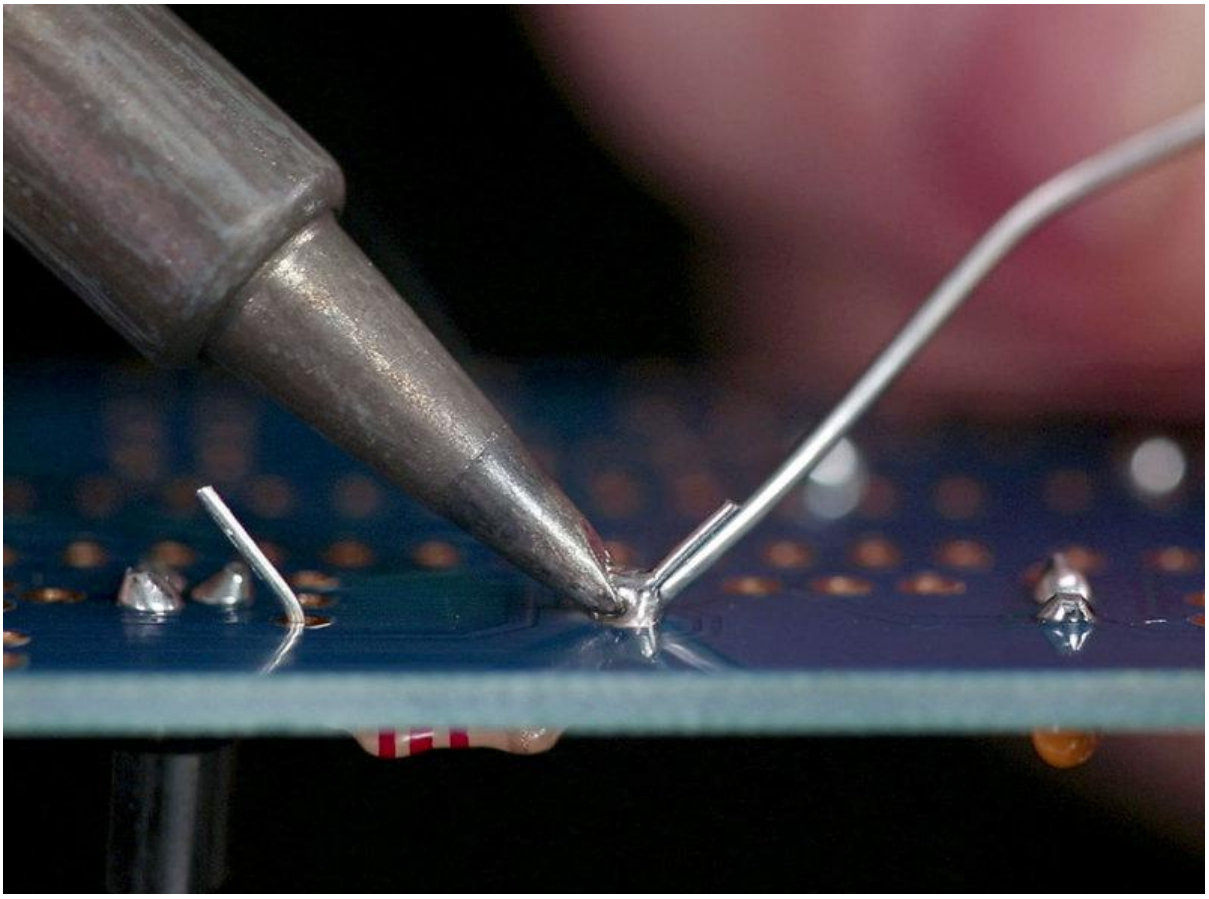
Collin's Lab: Soldering

Created by Collin Cunningham



https://learn.adafruit.com/collins-lab-soldering

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Video

It's sad to think of all the awesome things that won't be built because some folks are turned off by the idea of soldering. Such missed opportunity! Soldering is the fun!

In an effort to demystify, clarify & familiarize, we bring you the above internet video. Please share it with someone who thinks soldering is "not for them" and together we can make the world a better place – filled with blinking circuitry!

NEVER use acid-core solder or acid flux (often labeled as zinc chloride), which are used for plumbing, stained glass, and jewelry. These solders and fluxes are not for use with electronics. The acid will eat away and destroy your soldered connections.

Transcript

The soldering iron ... a powerful tool ...

those who wield it are granted the ability to bond metal at the molecular level.

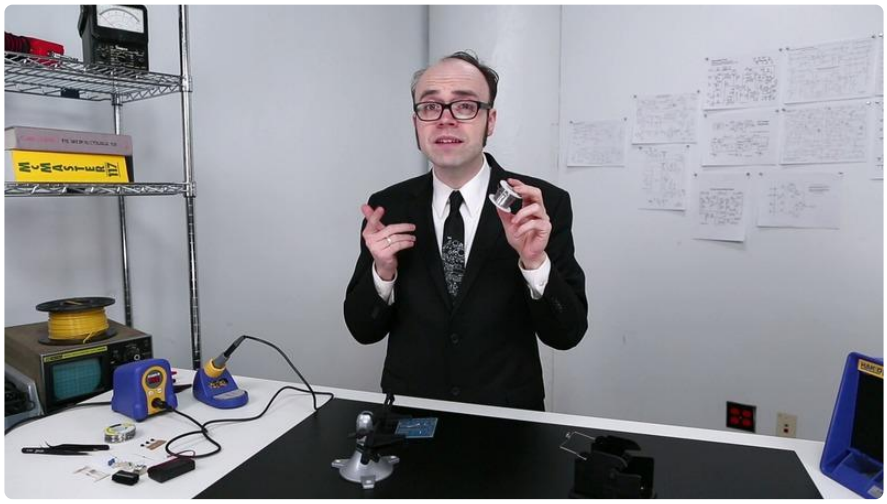
Building electronics is all about making connections.

And soldering makes excellent electrical connections.

And for those thinking it's too complicated, dangerous, or time-consuming

- well let's just get this out of the way ...

It's not :)



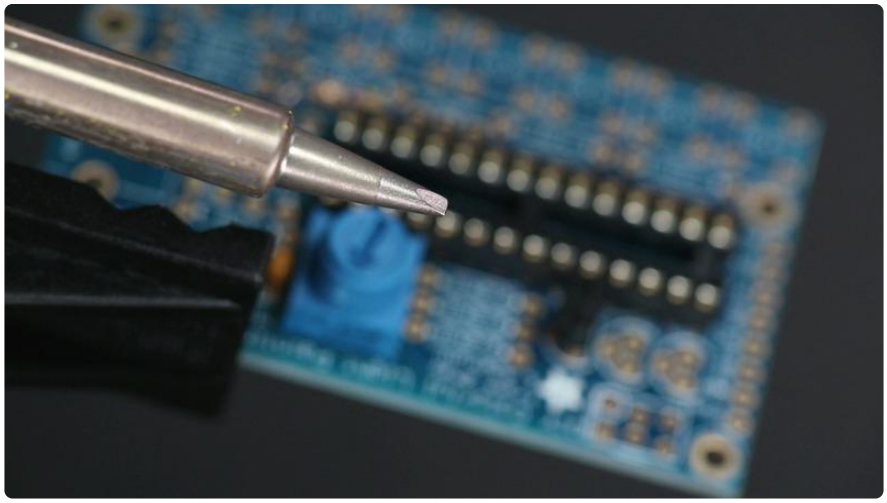
It helps to understand that solder isn't just some type of hot metal glue.

No - solder actually fuses to each surface - and the magic ingredient which makes it happen is - *heat*

And that of course, is where the iron comes into play.

A good quality iron will ensure we can supply enough heat to each solderable surface.

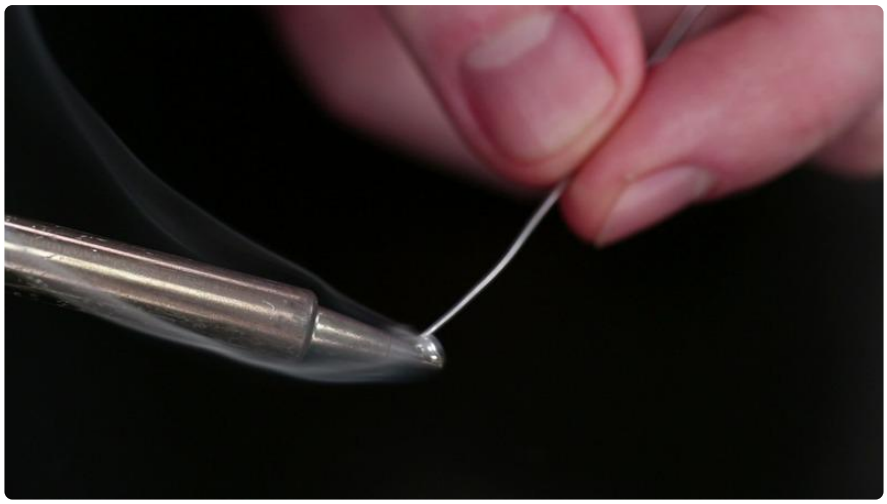
And a tip of appropriate size and shape will ensure that the right amount of heat is delivered to each surface.



For through-hole parts like these, a flat “screwdriver” tip works well.

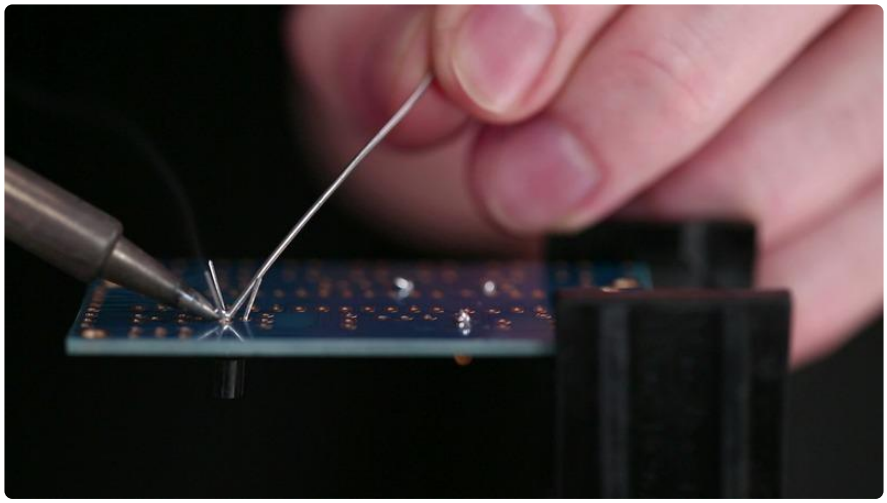
If we were soldering very small surface mount components we could use a fine point tip.

And if we were soldering a very large joint we could use a thick “hoof” tip with a wide contact area for delivering more heat.



Before using a new tip, be sure to “tin” it by applying a bit of solder.

And to keep the tip clean simply drag it through a bit of brass mesh or slightly damp sponge after each use. Just make sure your sponge isn’t soaking wet!



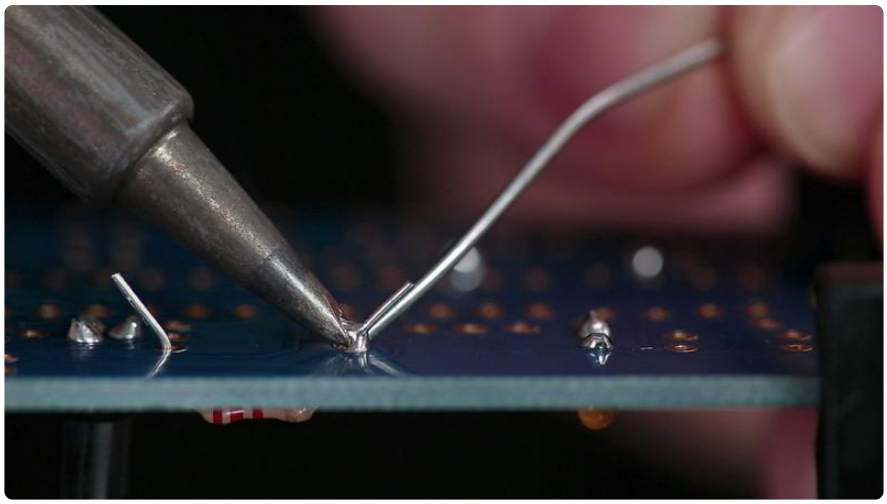
To heat both the component lead and the copper pad evenly, place the tip right here at the joint where they meet.

To avoid overheating, only apply heat for 2 seconds or less -

dwelling any longer can potentially damage some components or even the board.

So we get in - apply solder - and get out. All nice and quick-like.

Now about that “apply solder” part ...

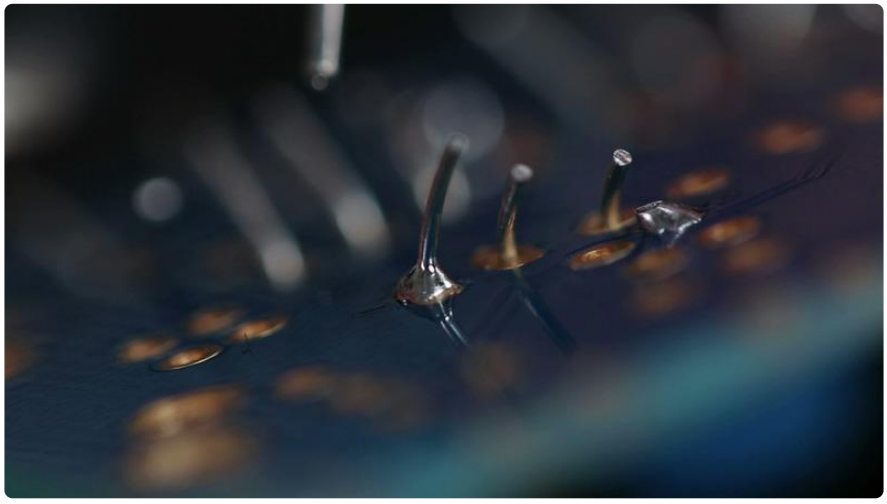


Notice I first touch the solder to the iron and then bring it down and around the component lead.

This causes the solder to quickly melt so I can smoothly “paint” the rest of the joint in place in one fluid motion.

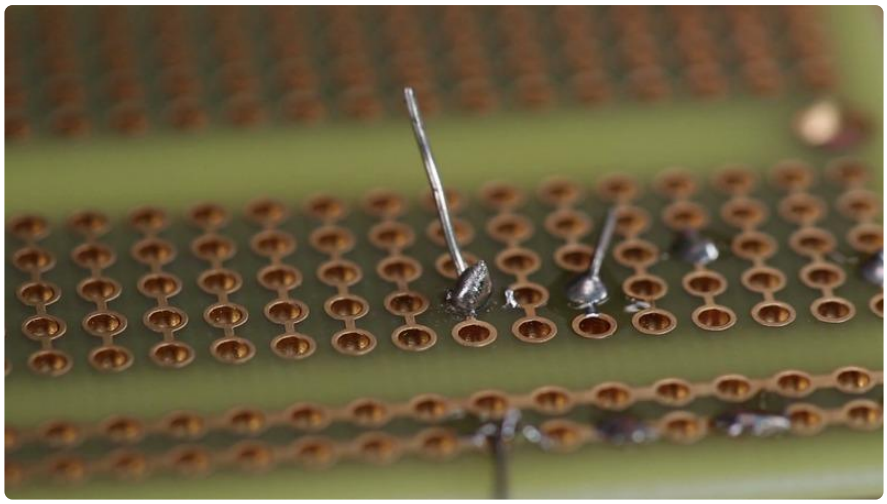
Simple & elegant.

After pulling the solder lead away, I remove the iron and allow the connection to quickly cool undisturbed.



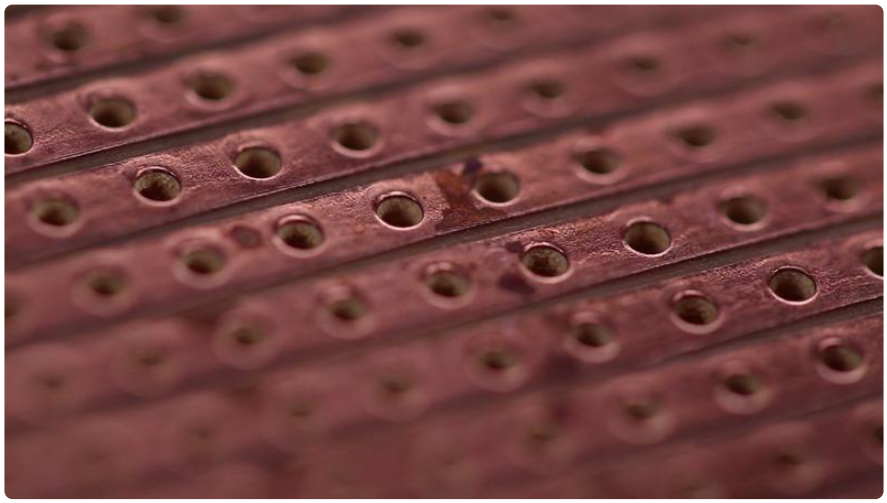
We can tell we have a good solder joint here because the surface is smooth and shiny with a slightly concave slope on each side.

It has a sort of fluid-like character to it - lovely.



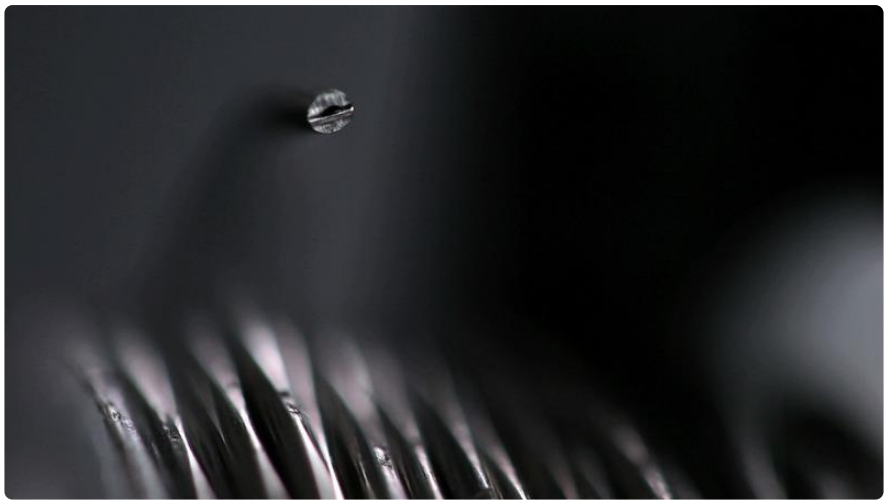
If the surface was rough or bulging excessively we may have what's called a "cold solder" joint. These occur when solder hasn't fully fused with each surface making the connection unreliable.

Cold solders can be caused by a lack of heat, motion during soldering or some type of coating on the metal surfaces.



Oxidation, which can be seen here as dark spots, prevents solder from fusing with the copper surface.

Thankfully, solder contains a special ingredient called "flux" which removes oxidation, leaving the surface clean and ready to fuse to the solder alloy.



We suggest using solder which contains “No-Clean” flux, as “water-wash” flux requires a hand-cleaning step afterwards to remove it.

It’s also important to choose the right temperature for your iron. If using Lead-Free solder, go up to 750 *F.

For Lead-based solder, somewhere around 650*F is fine. Soldering with lead-based solder is easier than lead-free, but lead-free solder is easier to find these days.

The benefits of good soldering are pretty obvious - sturdy, reliable electrical connections that last ...

... and won't be disturbed by a bit of dirt, dust or repetitive movement.

And speaking of repetitive movement - let's see if this thing works ...

Learn More

Definition & Origin

from Wikipedia ()

Soldering is a process in which two or more metal items are joined together by melting and flowing a filler metal (solder) into the joint, the filler metal having a lower melting point than the adjoining metal. Soldering differs from welding in that soldering does not involve melting the work pieces. In brazing, the filler metal melts at a higher temperature, but the work piece metal does not melt. In the past, nearly all solders

contained lead, but environmental concerns have increasingly dictated use of lead-free alloys for electronics and plumbing purposes.

There is evidence that soldering was employed as early as 5000 years ago in Mesopotamia. Soldering and brazing are thought to have arisen very early in the history of metal-working, probably before 4000 BC. Sumerian swords from ~3000 BC were assembled using hard soldering.

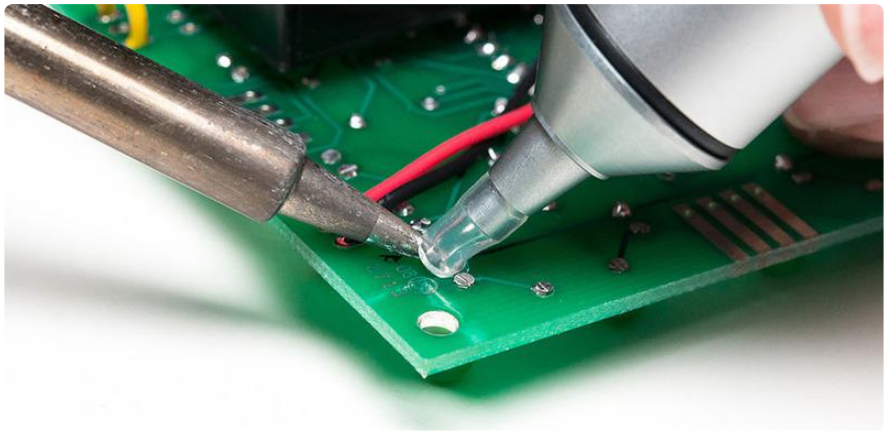
Soldering was historically used to make jewelry items, cooking ware and tools, as well as other uses such as in assembling stained glass.

Other Soldering Methods

Not all solder joints are made with a handheld iron. Check out some of the ways electronics are soldered -

- Reflow S ()oldering () - Solder paste is applied to the PCB's solder pads before components are put in place. Hot air is then used to melt the solder paste, fusing components to the board.
- Wave Soldering () - PCB is moved via conveyor above a pool of molten solder. A pump creates waves in the pool, which rise to meet the bottom of PCB and subsequently solder the joints in place.

Desoldering



Because soldering can create such strong connections, special tools are needed to properly remove a solder joint.

- Solder wick (http://adafru.it/149) - After being heated with a soldering iron, solder wick draws molten solder away from solder pads.
- Desoldering Pump (http://adafru.it/1597) - Uses suction to remove molten solder from a PCB.
- Hot Air Gun () - Heats a solder joint with a stream of hot air inorder to melt a joint without making direct physical contact.