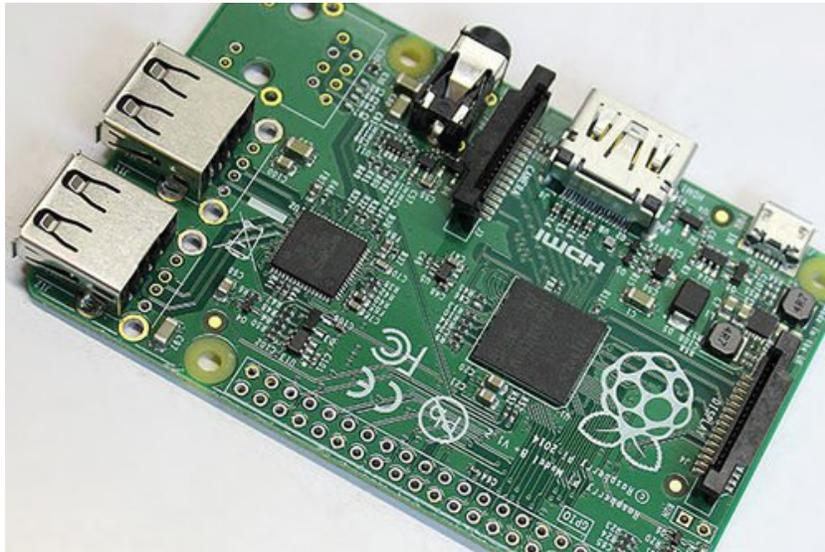


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Diet Raspberry Pi

Created by Phillip Burgess



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Overview



The Raspberry Pi finds itself in an ever-expanding gamut of project types...wearables, drones, internet of things and other embedded gizmos...and there are times when an extra-slim version of this already diminutive *wonderputer* would be just the thing.

Here we'll show how to trim some fat from the Raspberry Pi Model B+. You'll lose the Ethernet port and at least two of the USB ports, so this is really suited only to projects where size or weight take priority over connectivity.

DISCLAIMER: performing these modifications can be really rough on the board...this can easily go wrong and render the Pi inoperable. This is best attempted by experienced hobbyists. And even then...

Seriously. Don't attempt this on your precious one and only board. Always mount a scratch monkey.

Tools & Parts

In addition to a good **soldering iron**, you'll need a **solder sucker** and some **solder wick** for cleanup. Flux (either the brush-on or the pen kind) makes wicking easier, but isn't absolutely essential for success. Other tools include **flush diagonal**

cutters, pliers and **safety glasses**.

If you have access to a vacuum desoldering tool or a hot air solder rework tool, that might be helpful, but isn't a necessity...those are big-ticket tools.

You will also need one or two replacement single [USB Type A jacks \(http://adafru.it/e8l\)](http://adafru.it/e8l), depending how many ports you want.

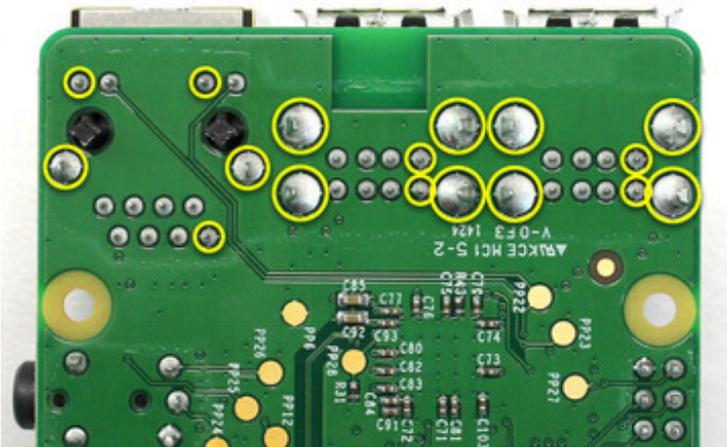
Small **pliers** and/or **tweezers** and a **Panavise** or a "helping hands" tool may also prove useful. **Anti-static mat** too, if you have one.

Steps

Before taking an iron to your Raspberry Pi, download and install an OS image on a microSD card and **confirm that the system boots successfully**. If it refuses to run in this state, we can troubleshoot and replace the board if needed. This is your last chance...once modified, there's no telling if a failure was from the factory or a result of your board work.

Physically altering the Raspberry Pi is a warranty-voiding operation. We cannot replace or refund modified boards. Test it first!

Dismantling the Raspberry Pi is extra challenging, even if you have prior desoldering experience. Lead-free solder requires higher temperatures, and this board's substantial ground plane draws away a lot of heat. But apply *too much* heat and you'll rip up traces or delaminate the board!



Lead-free desoldering is already tough, but a few points on the board are *particularly* challenging. They're connected to the ground plane, which becomes a big heat sink.

Be extra careful melting these... linger too long and the *whole board* gets uncomfortably hot!

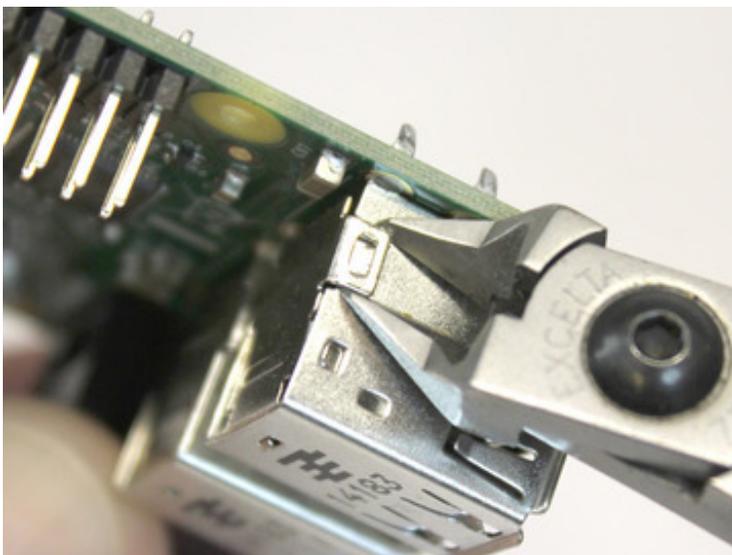
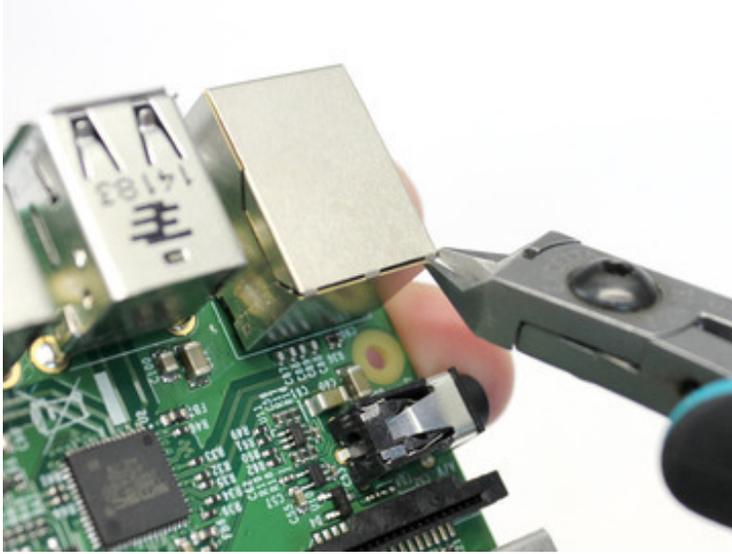
The conversion process is made a little easier by just **not trying to salvage the parts** being removed! Don't hesitate to clip leads, or completely dismantle the metal port housings. Anything to better access the area you're trying to desolder. Let it go.

There is no One Right Way™ to do this. The process should be adapted to your own particular skills and tools on hand. Even with a wealth of tools, it's still pretty time-consuming and may take a couple hours.

WEAR SAFETY GLASSES when clipping parts. Lots of sharp tiny bits are about to go

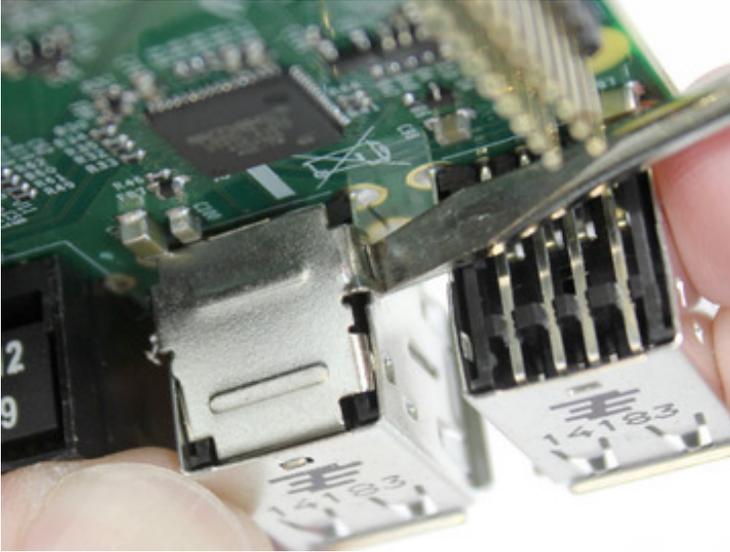
flying everywhere!

Remove Port Housings

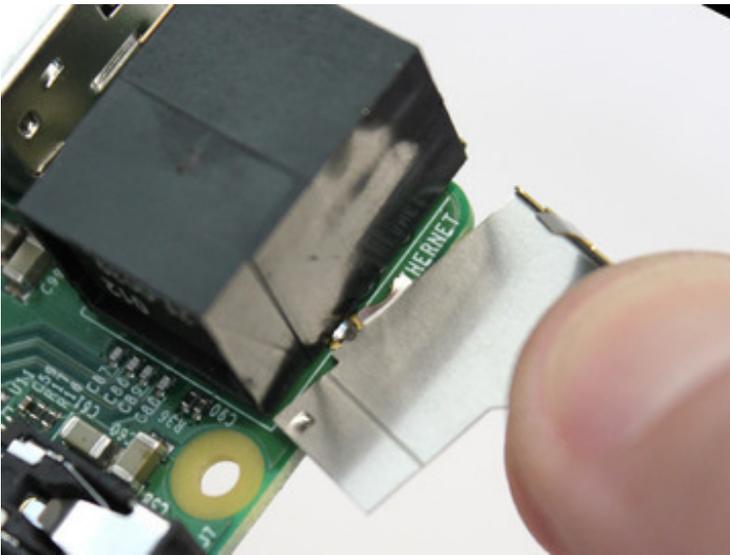


Dismantling the metal housings around the Ethernet and USB ports can help reduce the overall thermal mass when desoldering, and makes some pins easier to access. But they're destroyed in the process and can't be salvaged.

If you go this route, **watch out for capacitors C97, C99 and**



C100 when prying the backs off the USB ports. Don't shear them off the board!

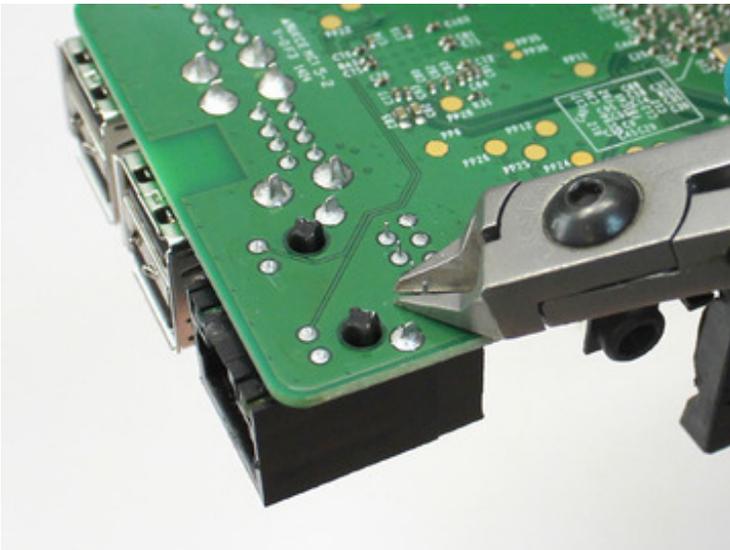


Desoldering Ports

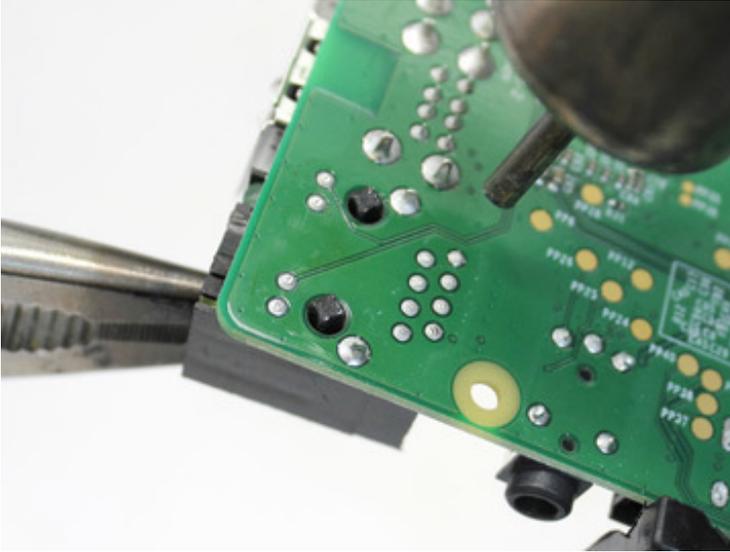
A vise is essential. This leaves both hands free...one for holding



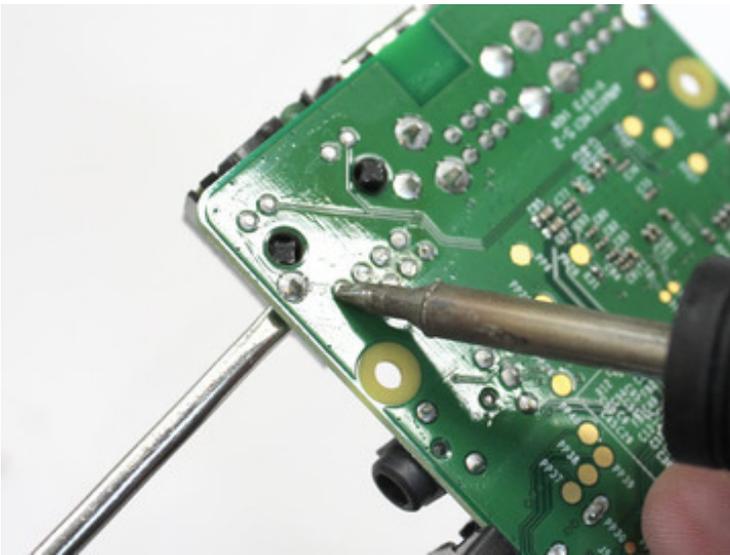
a soldering iron, the other for prying and desoldering tools. Also, the board's ground plane can get quite hot and shouldn't be handled.

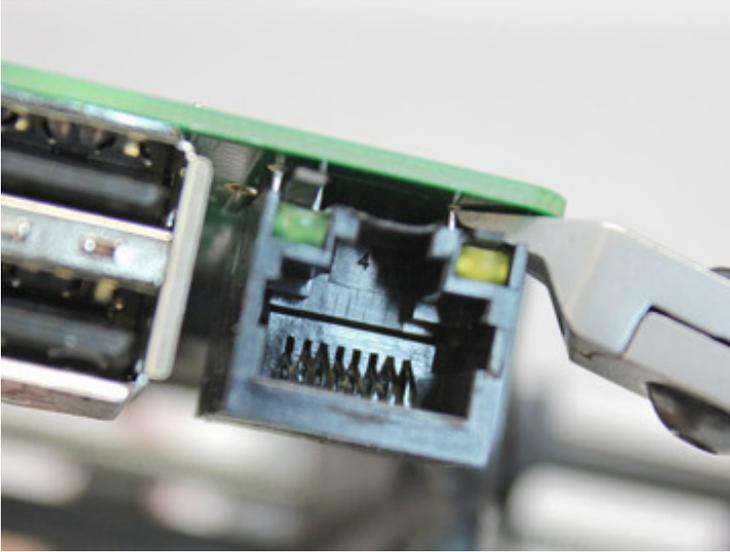


Removing parts often requires a rocking motion; heating one end while prying from the other, alternating sides. Cutting pins flush with the surface of the board reduces the amount of rocking needed...they'll clear the vias sooner.

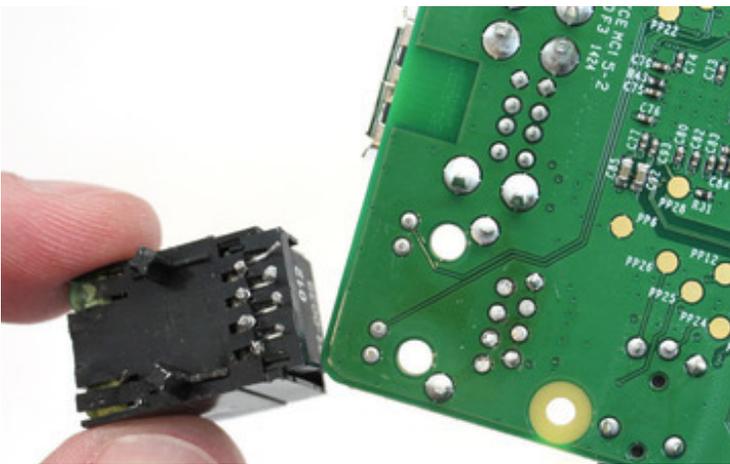


Though I have a solder reflow tool that should, in theory, be able to heat all the pins for extracting the part...in practice I was having no luck, and went back to my trusty soldering iron, heating, prying and rocking. Use whatever you have and works well for you.





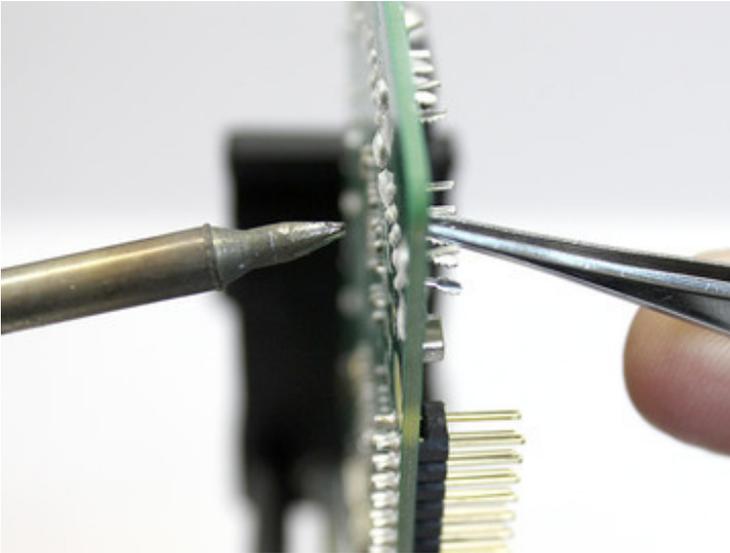
That thing about lead-free being hard to desolder? It was most troublesome with the Ethernet port LEDs, where the plastic housing would soften and deform before the solder would even melt. Fine then, let it deform, pry it up just enough to snip the legs of the LEDs. The remaining pins were desoldered with the heat-apply-rock technique.



Eventually — boop! Freedom! Don't worry about the remnants left on the board...we'll clean that up later.



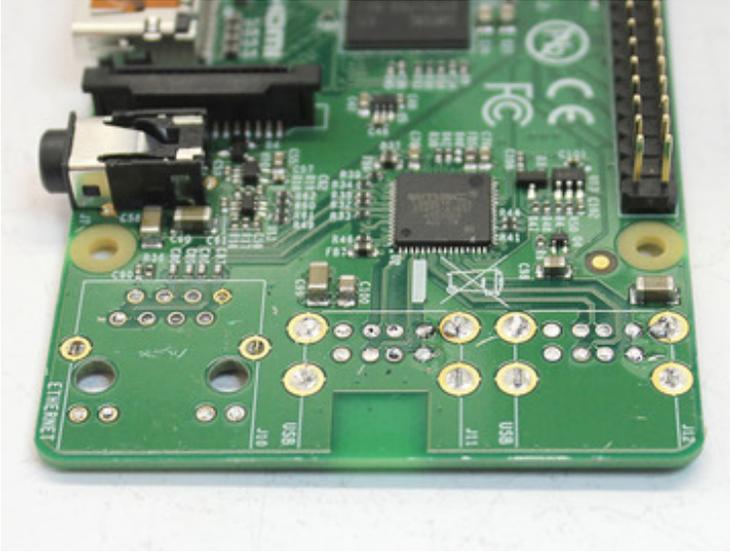
The USB ports similarly required a lot of grappling. Rather than trying to desolder the pins and pry the housing off the board, the housing was dismantled and the pins were clipped from the component side, and the schrapnel will be cleaned up later.



The sad remains of the ports are then cleared. As each pin is heated from the underside, it's plucked out with tweezers from the component side.

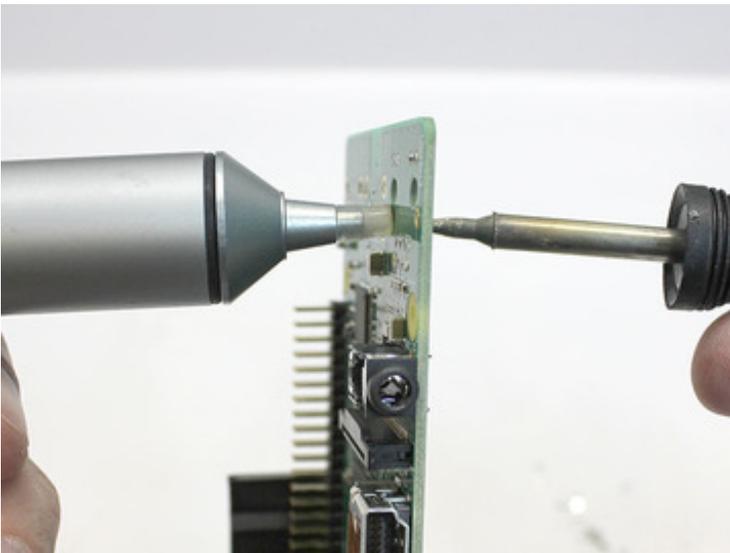
Cleaning Up

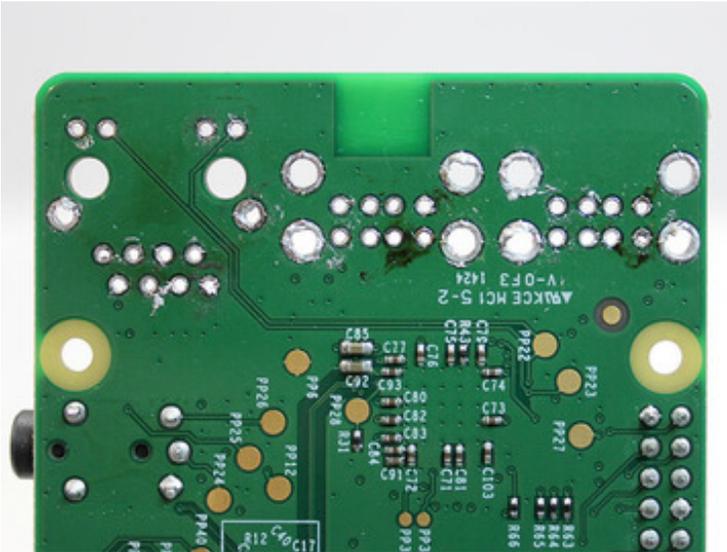
After all the pins are removed, most vias are still plugged with solder. Use the



soldering iron and a vacuum desoldering tool to clear these out.

A few holes will put up a struggle...mostly the ground pins. Sometimes it's helpful to *add* solder (preferably the leaded type) to a hole and heat it all the way through before using the vacuum tool.

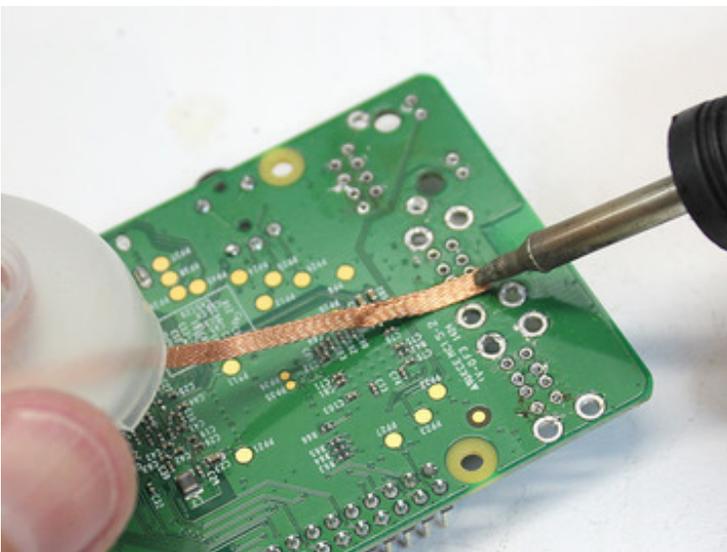




The holes are clear, but there's still a lot of solder debris on the board...this can bridge vias and cause mayhem, even if you're not using the corresponding ports.



Solder wick is heated under the tip of the soldering iron and rubbed across the areas to clean...this soaks up solder like a paper towel! **Do this on both sides of the board.** Applying liquid soldering flux first (either the brush-on or pen applicator type) makes this process a little smoother and cleaner.



You may need to revisit some holes with the solder-sucker.

Installing Low-Profile USB Jacks

Before proceeding, you can optionally let the board cool off, insert a microSD card and test whether it still boots. Without USB ports you won't be able to connect a keyboard and shut down cleanly, so don't do this with a card containing irreplaceable data.

If the system won't boot...or if it does boot, but the red power LED is flashing, disconnect power and look over your desoldering work for any bridged connections, or conductive detritus that may have been scattered on other parts of the board.

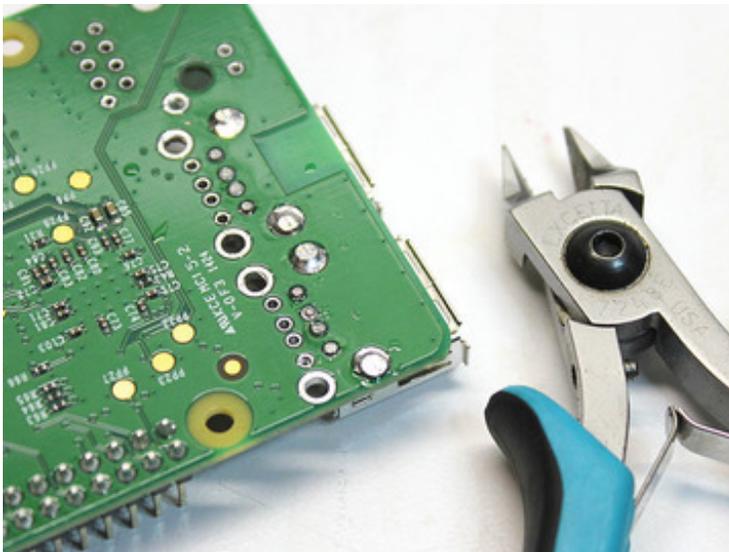


You can install one or two replacement USB ports, depending on your needs. Unlike the old stacked ports, these are single-height, so two is the maximum.

These should pop right into the old spots. Use the outer row of holes, closer to the board edge. The other row will remain unpopulated.



Flip the board over and solder the four pins and two metal housing support tabs. Once the solder's cooled, you can trim these close to the board so it sits flat.



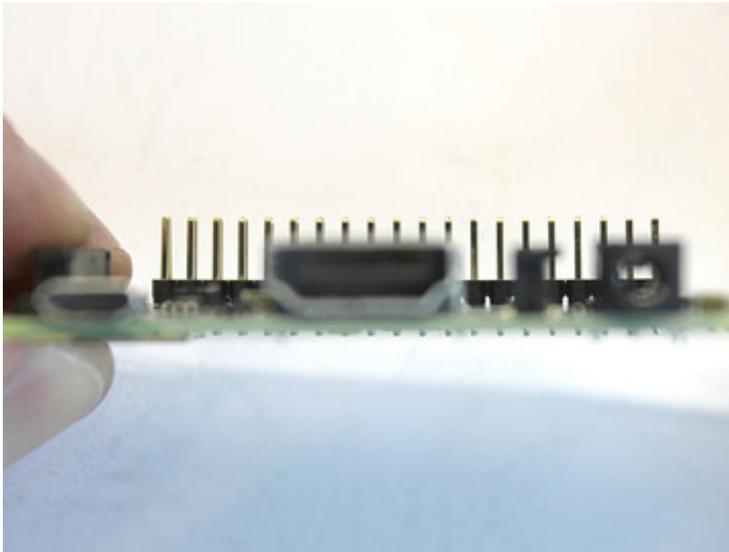
Once it's fully cooled, try attaching a monitor and booting the system from a microSD card.

If the transplant was a success, you should be able to connect a USB keyboard and log in.

The red “PWR” LED should be on steady. If it’s flashing, there’s an electrical short or a damaged component somewhere.

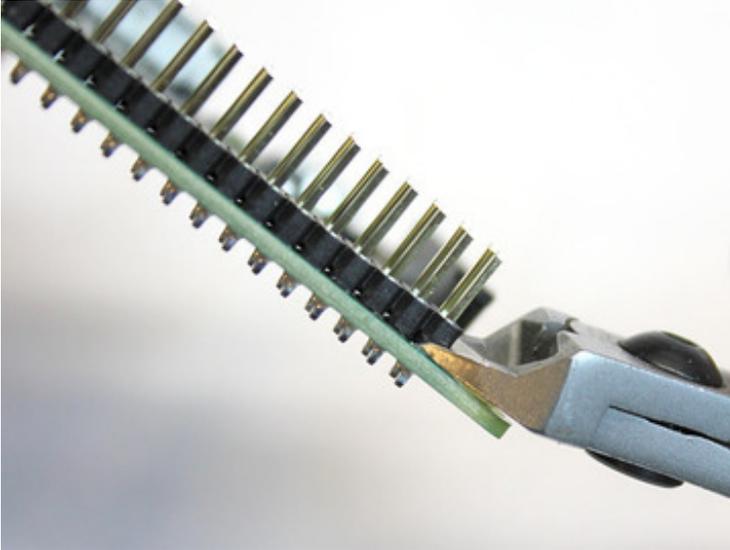
Further Modifications

Shortening the GPIO Header



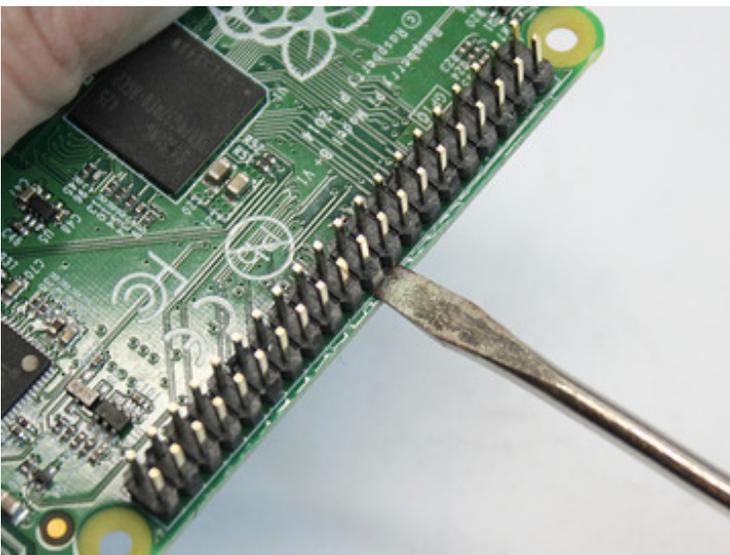
With the single-height USB jack(s) installed, the GPIO header is now the highest-profile part on the board. This can be shortened slightly while retaining full functionality...

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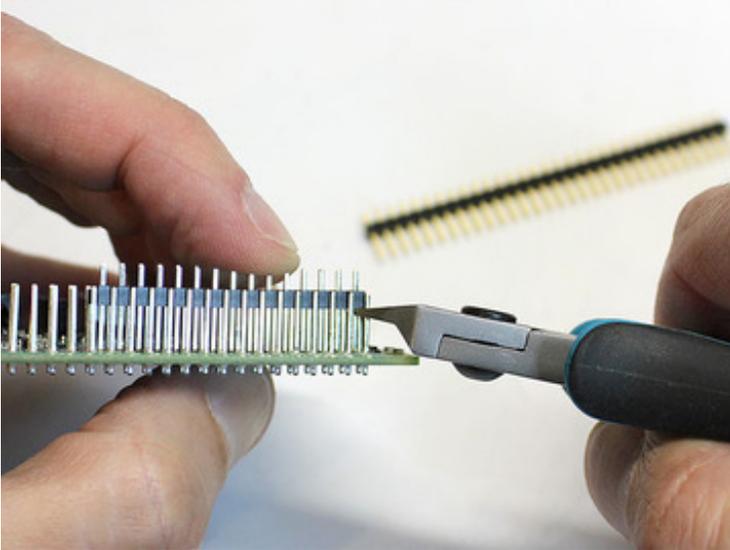
The edge of the header's plastic support can be lifted slightly using flush cutters. Be careful not to cut the pins!

You can then work along the edge with a small screwdriver to pry off this piece.

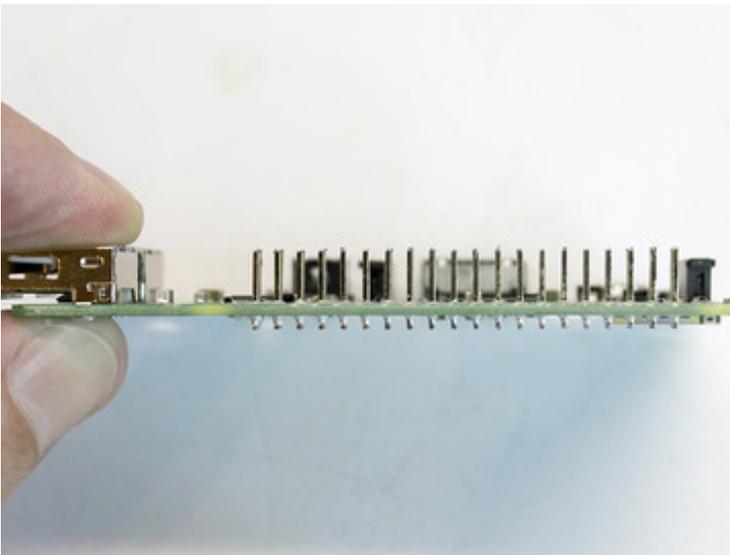


Your mileage may vary. With one Pi, the plastic support pried off cleanly. With another, this part need to be completely “nibbled” into dust!



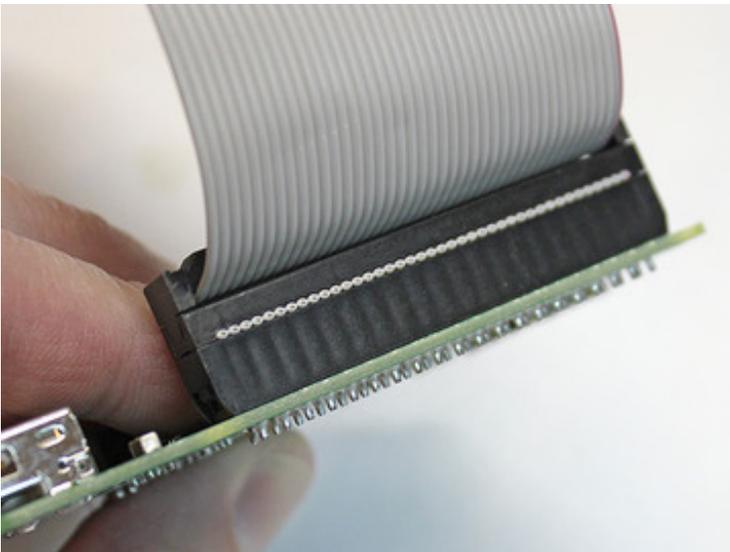


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Use a spare piece of single-row pin header as a template for trimming the GPIO pins. Wedge this *pin side down* between the GPIO rows, then trim along the plastic edge.



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When you're done, the GPIO header will be a couple millimeters shorter, roughly in-line with the video connectors on the opposite edge. Anything plugged into this (ribbon cables, Pi HATs, etc.) will sit just a little bit lower now.



Or, if you don't anticipate using the GPIO header at all (or just need a few pins and can wire to them directly), it can be completely desoldered and removed.

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Removing Additional Parts

If *extreeme* weight saving is needed (e.g. for drones), many of the ports and jacks can successfully be removed, as long the corresponding functionality is *never again needed* for your application (there's no going back with most of these surface-mount parts):

- GPIO header
- HDMI port

- Composite video/audio port
- FPC display connector
- Camera connector
- Micro USB power connector (if regulated +5V is instead fed to the appropriate pins on the GPIO header).

Most of these parts are about the same height, so there's little point in removing a subset as a space-saving measure. But for aerial applications, every gram counts...go nuts.

If all of the display options are removed, then the system can only be administered remotely (e.g. ssh through WiFi). If all of the USB ports have also been removed, then the only way to log directly into the system is with a serial console cable connected to the appropriate pins on the GPIO header.

Sometimes it's easiest just to have a second, unmodified Raspberry Pi for administration tasks. Move the microSD card to this system, boot and perform whatever configuration is necessary, then shut down and move the card back to the pared-down board.