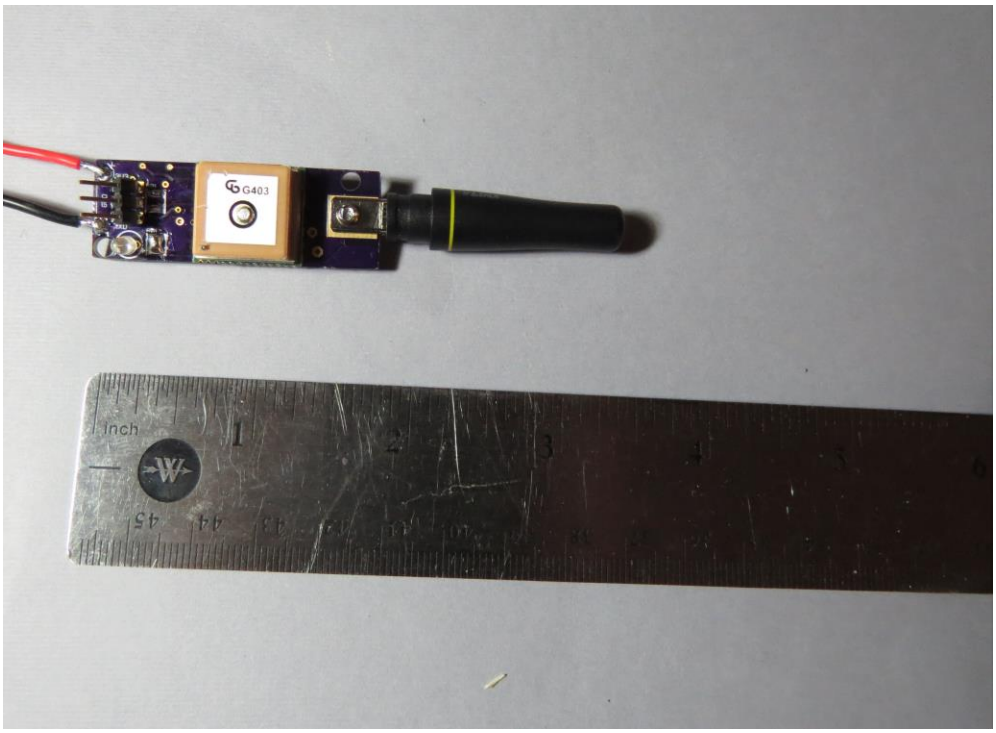
Eggfinder Mini
Assembly Manual

Rev. A7



© 2017 Eggtimer Rocketry
All Rights Reserved

California Proposition 65 Warning

WARNING: This product contains chemicals (lead) known to the State of California to cause cancer and birth defects or reproductive harm.

This kit includes a special low-temperature ultra-fine leaded solder wire. Including the solder with the kit ensures that you will have solder that can be used to mount the surface-mount parts in the kit. Leaded solders have been used for over a century in electronic assembly, but you should take the following precautions when using it (or just about any chemical, for that matter):

- Do not eat or drink while using it
- Wash your hands after handling it
- Keep it in the protective bag when you're not using it

The MSDS can be found at

http://www.kester.com/download/245%20FluxCored%20Wire%20Lead%20Alloy%20SDS.pdf

Important Regulatory Information

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

It is intended to be used ONLY for educational and experimental use in Class II/III amateur High Power Rockets which are classified as aircraft by the Federal Aircraft Administration (CFR 14 §101.25), and which must by FAA and NFPA regulations be operated at least 1,500' away from any populated buildings. Although unlikely, this device may cause interference with consumer devices that run on the unlicensed 902-928 MHz band, and therefore must not be used in residential areas.

The Eggfinder Mini uses RF modules in the 902-928 MHz ISM band manufactured by Hope RF, model HM-TRP-915. They are intended to be used only in the United States. These modules have been tested by Hope RF to be compliant with the FCC Part 15 regulations for non-licensed intentional emitters, and as such have been permitted to be imported into the US. However, Hope RF (at the time of this document) has not obtained formal certification with the FCC. As a hobby kit, designed for educational and experimental purposes, the Eggfinder is considered by the FCC to be "generally exempt" from authorization requirements. Nonethless, we have made a good faith attempt to comply with all technical regulations, and you should too by building it **exactly** as per the instructions, and by using only the antenna on the transmitter module that is included with the kit.

Because the Eggfinder Mini runs on an unlicensed band, there is no protection against interference from other sources; basically, you get what you get. We've done substantial testing and are confident that your Eggfinder system is unlikely to be significantly affected by outside radio sources, but there's no guarantee.

If your Eggfinder Mini causes interference in a residential setting, or with licensed radio systems (such as TV or ham radio), you **must** stop using it until you correct the problem. This is extremely unlikely given the small amount of power and the "tightness" of the transmitter's output, and in particular the distance from any populated areas that HPR rockets must be flown. Nevertheless, you need to be aware of this, and be willing to abide by the rules. These are the same rules that govern other non-licensed transmitters, such as cordless phones, WiFi and Bluetooth® devices, and garage door openers.

Important Links:

FCC Part 15 (governing unlicensed intentional emitters)
http://www.ecfr.gov/cgi-bin/text-idx?SID=adb12f74b498e43ec453f7899d9df0fd&node=47:1.0.1.1.16&rgn=div5

Hope RF HM-TRP Documentation (FCC test documentation)
http://www.hoperf.com/upload/rf/HM-TRP-915(20dBm)-FCC.pdf

FAA Regulations for Amateur Rocketry (Part 101)
http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&rgn=div5&view=text&node=14:2.0.1.3.15&idno=14

~~~~~~

Before You Start…

• Go to our web site at www.Eggtimerrocketry.com and download the latest Release Notes.

• Go to our web site at www.Eggtimerrocketry.com and download the latest Assembly/Users Guide..

• Read them thoroughly before starting… it will save you some grief later, we promise!

~~~~~~

Thanks for buying an Eggfinder Mini GPS Tracker! The Eggfinder Mini is a hobby rocketry GPS tracker that uses a GPS module and a 900 MHz license-free transmitter module to broadcast your rocket's location in real-time to a computer or tablet. With appropriate GPS tracking software, which is available for free on the Internet, you can actually track your rocket in flight, and ultimately find out exactly where it landed.

Like other Eggtimer Rocketry products, we sell it as a kit, to keep costs down and provide an outstanding value. This means that you have to do a little work, of course, but considering that most hobby rocketeers that would use our products have some degree of electronics expertise, this should not be much of an impediment. If you do not have any experience soldering kits such as the Eggfinder, we recommend that you ask around… chances are that somebody in your rocketry club would be more than happy to assist you for a small bribe (beverages work well!).

The Eggfinder Mini is the smallest GPS-Radio tracker around, it fits into an 18mm (BT20) body tube, and it's just over 3" long including the antenna. It works with all Eggfinder receivers, and the frequency can be programmed to any of of the 72 frequency/ID combinations using the Eggfinder LCD display receiver. Despite its small size, it has a range of well over 20,000', so it's great for about 99% of the HPR flights that most hobbyists do.

About Soldering Your Eggfinder Mini…

Assembling your Eggfinder Mini isn't that hard, but we recommend that you don't choose it as your first kit project. You must be able to solder small components using fine solder and get nice shiny solder joints. If you have never soldered before, you need to learn anyway, because if you are going to do rocketry electronics you're going to be doing some soldering. If you want to get into advanced projects like telemetry, you're probably going to be doing a lot of soldering. We recommend that you get a few small kits from Ramsey or SparkFun, put them together, and hone your skills on them first. There's a lot of fun stuff out there, so go for it!

The Eggfinder Mini uses mostly Surface Mount Technology (SMT) parts, but they are large by SMT standards, and are within the realm of being hand-solderable. In our case, there are two "modules", the GPS module and the RF module, that could potentially be damaged by the heat of surface-mounting them in an oven; that's why we chose to have you solder them. In order to help make your assembly successful, we have included some very fine (.020"), very low temperature (about 180°C), no-residue solder. This is not the stuff that you get at Radio Shack… it's designed for soldering small temperature-sensitive parts without transferring much heat to the part itself.

Important note about using extra flux with this board: The solder that comes with the kit is Kester 245, it uses a water-based "no-clean" flux. If you wish to use extra flux with the board, it MUST be compatible. You want a liquid (not paste) water-based no-clean flux. Kester 951 is ideal, if you can get it. Chip-Quik sells little 2ml tubes for about $2 each (unfortunately they sell them in 6-packs, you can't just get one) which works very well. If you decide to add flux, you must use only a tiny amount. One drop will suffice for the entire GPS module. DO NOT use Rosin Core flux, or you will make a mess of the board and possibly damage components. We have built many kits without using any additional flux without any issues, the board is pre-tinned to make solder adhesion easier so in general you should not need to use additional flux.

For soldering components on a board like the Eggfinder Mini, we recommend a small pencil soldering iron, about 15W. If you are only going to use it occasionally, Weller makes a decent cheap 12W iron, it's about $15. There is also a similar iron that's sold by ECG. We like those, but the copper tips seem to oxidize and corrode rather quickly compared to some more expensive irons; fortunately, the tips are replaceable and cheap. Better would be a fancier soldering pencil with iron tips; those run about $30, but they'll last forever. The best iron would be a temperature-controlled solder station, they typically start at about $50 for a cheap one and can go to a few hundred dollars if you want to get really fancy. Weller makes a good one for about $50, if you make the investment that will probably be the last soldering iron you will ever need to buy. These solder stations usually have a little well with a tip-cleaning sponge, so they end up taking less room on your workstation too. Get the smallest tip you can find, preferably a small conical tip. It should be just about the same width as the GPS module pads. If you have a temperature-controlled iron, set it to 680F; you may need to adjust that temperature up or down a little if you find that the solder balls up (too cold) or fizzles without flowing out (too hot).

General Assembly Information

We're sure that you are ready get started, but before you do you will need to get some tools together. The tools that you will need are:

___ Low-wattage soldering iron, 15W or less, with a fine conical tip

___ Small needle-nose pliers

___ Small diagonal cutters

___ Tweezers to handle the SMT parts

___ A "third hands" stand or small vise to hold the board in various positions

___ A small damp sponge or tinning block for cleaning the tip of your soldering iron

___ A lighted magnifier, for inspecting solder joints (not essential, but very helpful)

___ A jeweler's loupe or small 10x magnifier, for inspecting the SMT solder joints (again, not essential but VERY helpful)

___ A well-lighted place to work, preferably with a wood or metal surface, also preferably not carpeted

___ Some PAPER masking tape (do NOT use Scotch® tape or electrical tape)

Each installation step has a check-off line, we strongly recommend that you check them off as you go, and that you perform the steps in sequence. We have listed the steps in order to make it easiest to assemble the Eggfinder, deviating from them isn't going to make your life any easier.

We strongly recommend that you consult the assembly pictures on the Eggtimer Rocketry web site, under the "Photos" section. http://www.eggtimerrocketry.com/page16.php

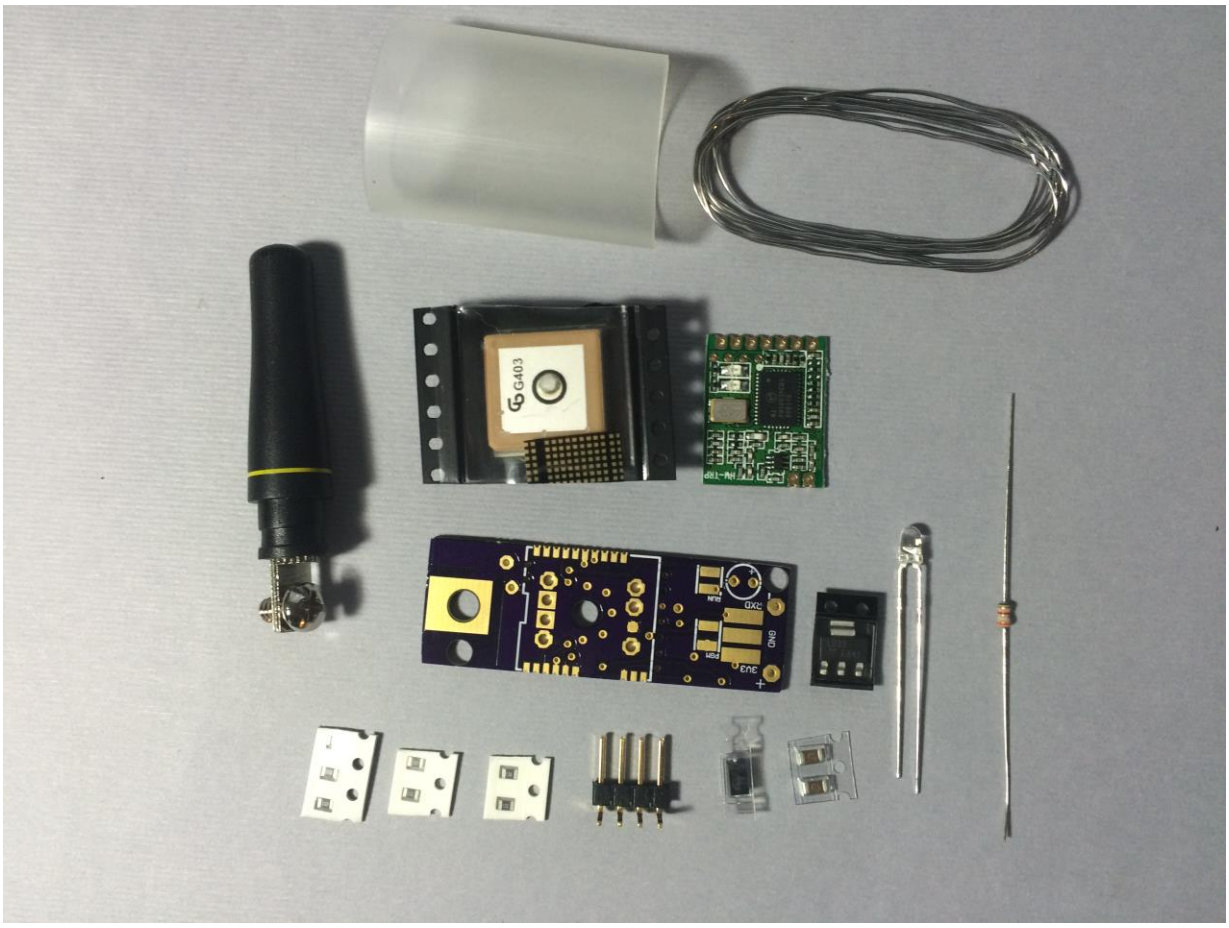
Each step is pictured, so you can see exactly what you need to be soldering. Looking at the pictures as you go will help prevent you from soldering the wrong thing, or putting something in the wrong way.

Assembling your Eggfinder Mini Board

Step 1: Sort the Components

Before you start soldering anything, you need to lay everything out and make sure that you are familiar with all of components, and that you have everything. (Yes, we ARE human and sometimes make mistakes… if you are missing something, let us know immediately so we can send you whatever you need). You should have the following parts, check them off as you sort them…

	Qty	Description
__	1	Circuit board
__	1	Maestro Wireless A2235H GPS module
__	1	Hope RF HM-TRP-915 RF module
__	1	NCP1117-33 3.3V voltage regulator
__	1	FM4007 diode (black with a stripe on one end)
__	1	3mm Amber LED (it may be clear)
__	1	330 ohm 0805-sized resistor (marked “331”)
__	2	2.2K ohm 0805-sized resistor (marked “222”)
__	1	10K ohm 0805-sized resistor (marked “103”)
__	1	10 uF 1206-sized capacitor (brown, unmarked)
__	1	1/8W leaded resistor (we use it just for the leads)
__	1	4-pin right-angle header strip
__	1	2 dB stubby screw-mount antenna & screw
__	1	Coil of .020” 63/37 No-Clean solder wire
__	1	12” 3-conductor jumper, female-female
__	1	1 ½” long x ¾” dia. clear heat-shrink tubing



Note that some of the components are static sensitive, so you should avoid sources of static electricity while you are handling them. We recommend that you assemble the Eggfinder Mini on a wood or metal surface unless you are fortunate enough to have a high-temperature anti-static mat (don't buy one just to build the Eggfinder Mini, however!) Avoid putting it on plastic surfaces that generate static, and preferably put it together in a room that's not carpeted. That being said, it's very unlikely that you will zap any of the components in the Eggfinder Mini with static electricity, but consider yourself notified of the possibility…

Also note that some of the components are polarized, i.e. it matters which way you put them in. If you solder one of these components in backwards, the effect will range from something not lighting up (LEDs) to nothing at all working (diode). It is CRITICAL that you test-fit the parts before you solder, and that you make ***SURE*** that you have them pointed the right direction before soldering. Like the old adage says, "Measure twice, cut once." If you solder a part onto the board incorrectly, it can be a minor pain to remove if it only has two pins, or it can be virtually impossible for something with a lot of pins. ***The Eggfinder Limited Warranty does not cover incorrect assembly***, so if you mess up badly enough you may end up having to get another kit and starting over; neither of us want that.

There are several different resistor values, so make sure you get the right ones in the right place. They are marked on the boards, but once again you need to make SURE that you have them in the right place before soldering. Unsoldering parts on a small circuit board like the

Eggfinder isn't a lot of fun, even if you have a vacuum desoldering tool. Trust us, we've been there before…

It is very important that you assemble the Eggfinder Mini in the order listed. This makes it easier to access the surface-mount components, if you start soldering out of order it's going to be tough for you to get to the pads of the SMT parts. Some of the instructions will call for you to tack-tape parts to the board to maintain alignment while you solder, or to protect sensitive areas from solder. You should ONLY use paper masking tape for that purpose, DO NOT use "Scotch"® tape or electrical tape for this; plastic tapes can pick up static electricity and damage parts, and electrical tape tends to leave a sticky residue.

Before you solder anything, make ***absolutely*** sure that you have the correct part and that it is inserted in the board correctly. The board has all of the component values, outlines, and polarities silk-screened on the top, so there shouldn't be any doubt about what goes where and how. Nevertheless, if you have any questions about the assembly procedure, do not hesitate to drop us a line at support@eggtimerrocketry.com before you solder the parts to the board. You may have to wait a day for the answer, but it could save you a lot of grief later on!

The Eggfinder Mini Limited Warranty does not cover damage to parts while attempting to desolder them because you inserted something incorrectly. We spent a lot of time making sure that the assembly instructions were clear, but once again if you have any questions about the assembly procedures drop us a line at support@eggtimerrockety.com ***before*** you solder.

OK, so let's get started…

Mounting the GPS Module

The very first thing you will be mounting is the Maestro Wireless A2235H GPS module. It's a square part about 5/8" square and ¼" deep, it is actually a small circuit board with an integral patch antenna. There are very tiny parts mounted on the board, fortunately you don't need to worry about any of that, you're just going to solder the GPS' pads onto the Eggfinder Mini board.

It is CRITICALLY important that you get this part mounted properly, because once you solder it in it will be impossible to remove it. We're not talking "difficult", we're talking "impossible". Work slowly and carefully!!!

It is also very important that you do not overheat the GPS module. While it IS designed to be heated in a commercial SMT reflow oven, it CAN be damaged by overheating. You're not likely to generate enough heat to damage the module, but you don't want to be taking chances. The solder joints on the top of the board are primarily electrical connections, the ones on the bottom of the board provide the main mechanical mounting. While every solder joint is important, the ones on the bottom are especially so, because they hold the GPS module in place and provide a good ground path for the GPS patch antenna.

The first step in mounting the GPS module is going to be to solder short wires (cut from the 1/8W resistor) to the channels on the side of the board, so that when you place the GPS module on the board it aligns with the wires and makes all the pads line up nicely.

Before you do this, though, you need to inspect the board, and make sure that the channels are clear of any debris or dust that may have accumulated during manufacturing. Inspect them with a 10x jeweler's loupe, if you see any "flash" or debris you'll need to clean them. With an old toothbrush, gently sweep the channels outwards, do not sweep across them. DO NOT use a wire brush for this! Inspect them again, until you're satisfied that they're clear and clean.

__ Clamp the PC board horizontally in your third hands holder, so that the little "half moon" cutouts on one side are facing up.

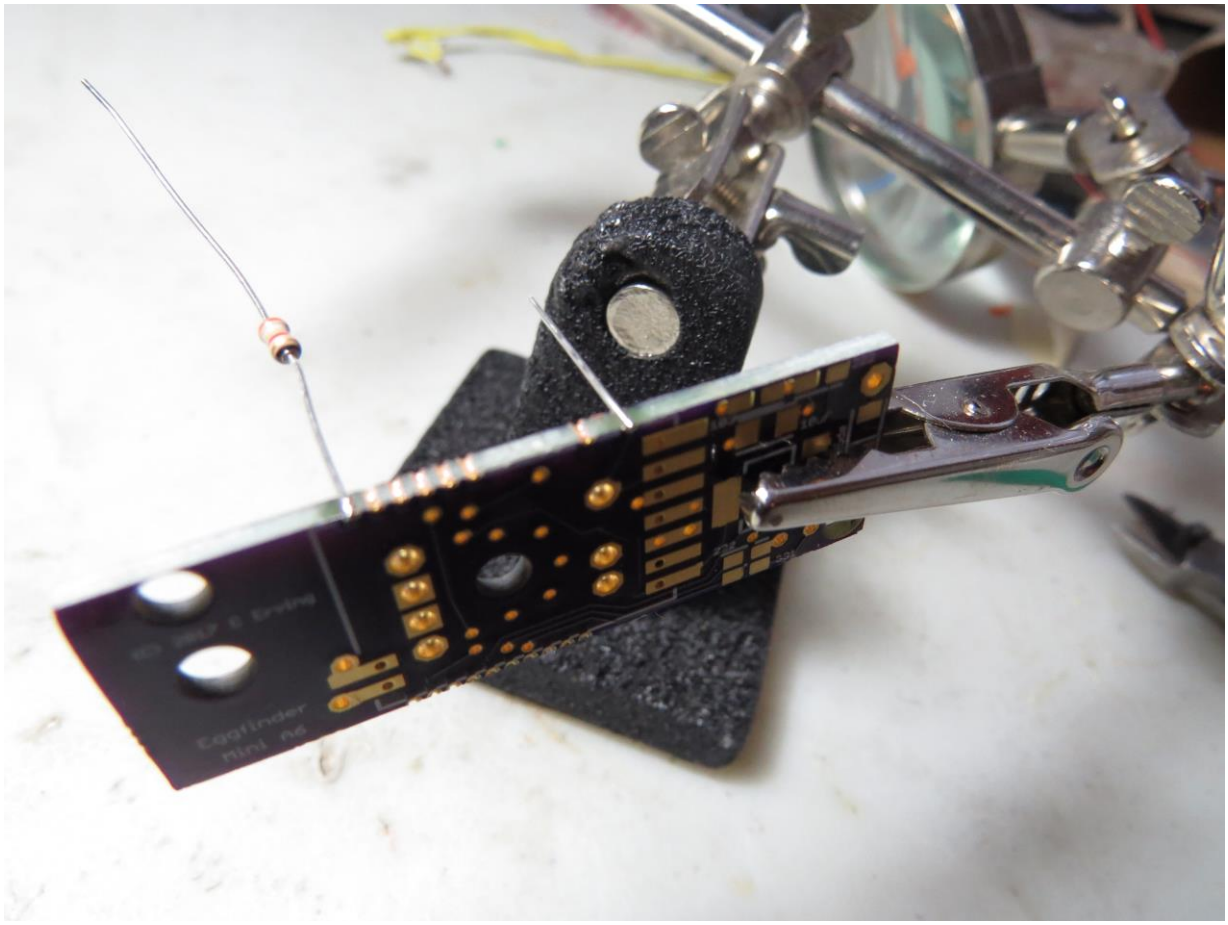
__ Using just a tiny bit of solder, put some solder in the channels at each end. It only takes a tiny bit, so don't make a big solder glob that you're going to need to clean up later. Especially don't get any on the GPS-side pads, it will prevent it from laying down flat on the board later on.

__ Take the 1/8W resistor and hold the end against one of the pads that you just tinned, so that it's sticking out of the side that the GPS module is going to be mounted, but flush with the side of the board opposite the GPS module. Holding it in place, heat up the end so that the solder flows against the lead, remove the heat, then hold the resistor there for about 5 seconds so the solder cools. You may find that your "third hands" holder is helpful for getting this right.

__ Clip the resistor lead that you just soldered halfway between the soldered end and the base of the resistor.

__ Now, solder the clipped end to the other pad that you just tinned, using the same procedure. When the solder cools, clip the resistor off at the base.

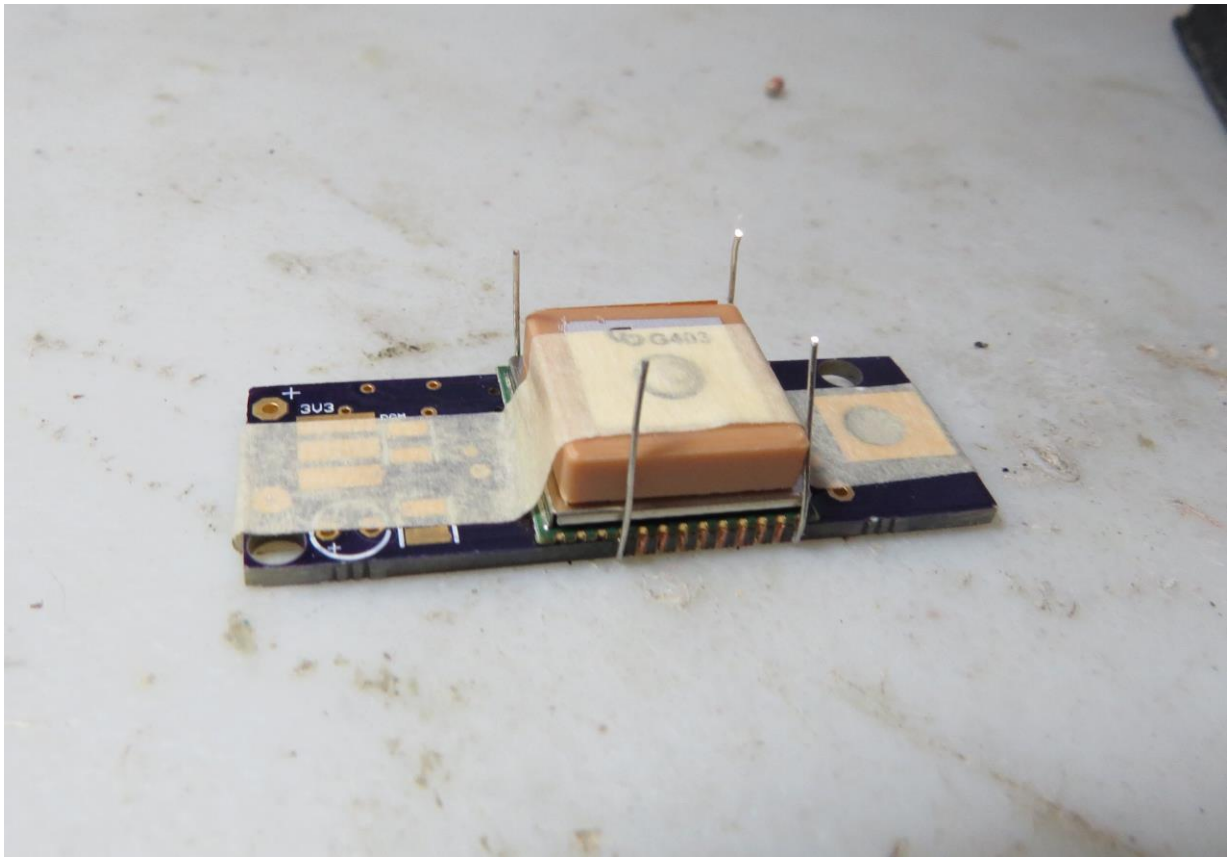
You should have two wires sticking out of the side of the board, pointing outwards from the side where the GPS module mounts.



__ Unclamp the board and turn it around so the other side with the half-moon pads is facing up. Tin the two channels at the ends, and solder resistor leads in them just as you did with the other end. Unclamp the board.

You should now have four wires sticking up from the edge of the board. If any of the leads are sticking out underneath the board on opposite side from the GPS, gently clip them flush. If you got any solder on the pads themselves, you'll probably have to unsolder that wire, clean it up with some desoldering wick, and resolder the wire. It's important that you don't get any solder on the GPS pads (yet) because it will prevent the GPS module from laying down flat on the board.

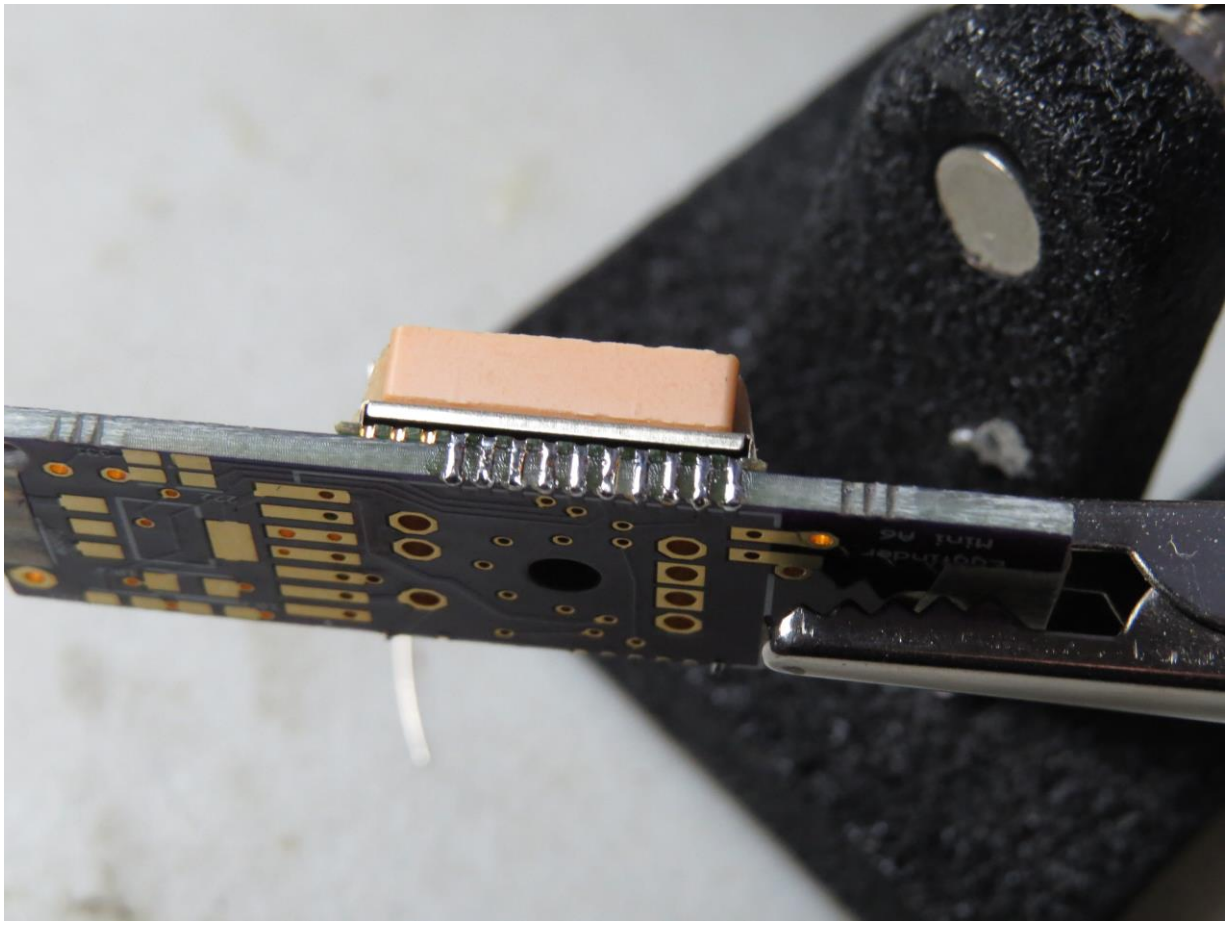
__ Gently set the board down on the table. Place the GPS module on the board so that the pads align with the four resistors. Note that on one cornet the wires are not at the end of the GPS module, they're four pads inwards. If you did it right, the GPS module's half-mood pads will be in perfect alignment will all of the channels on the PC board. You may need to squeeze the leads in slightly to get a good fit.



__ Cut a piece of paper masking tape about 3/8" wide and 2" long, and carefully tape the GPS module down to the PC board. Make sure it's a nice snug fit, you don't want the GPS module coming loose in the next step.

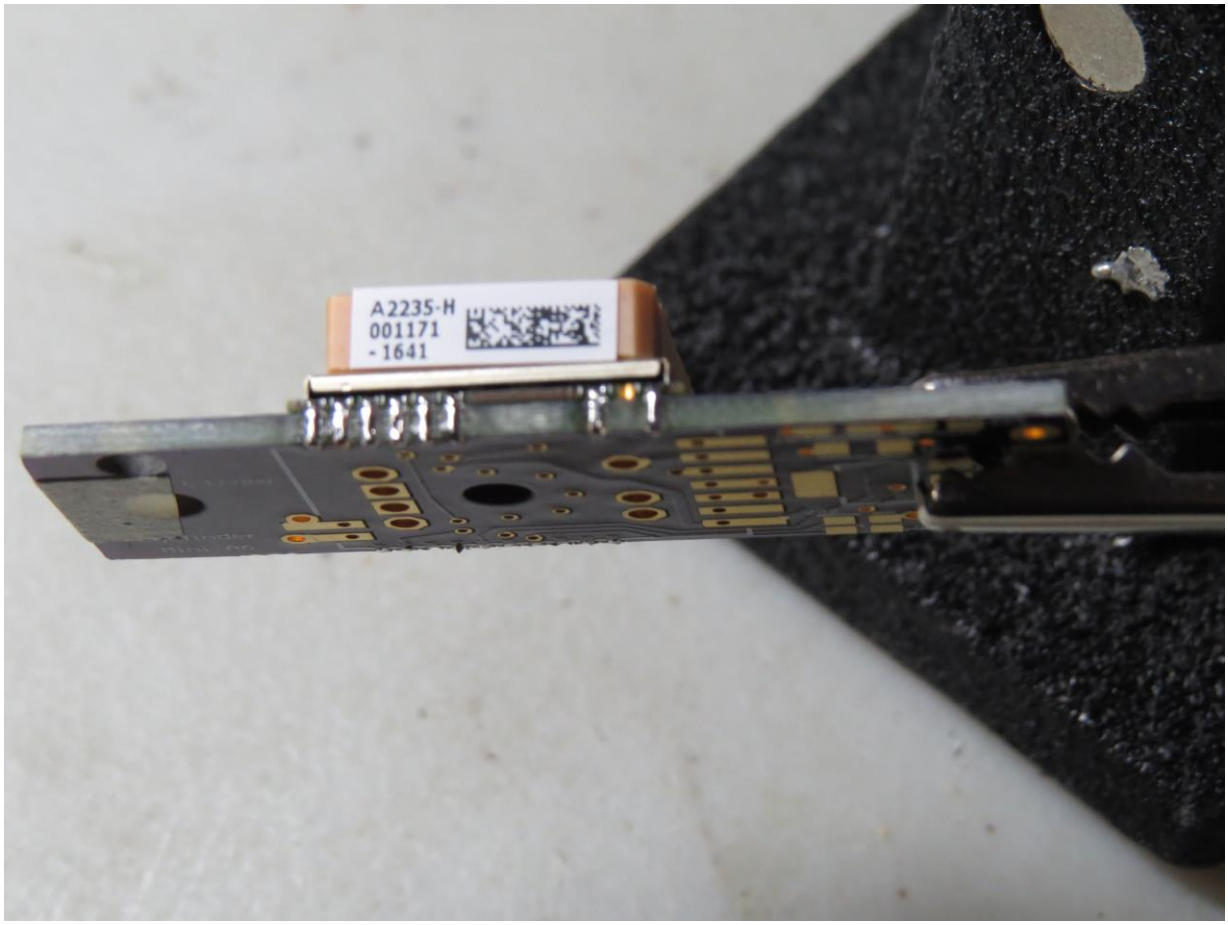
You might also want to cut a piece of masking tape about ¼" wide x 1" long, to cover the open slots in the GPS module's metal shield. That will help prevent any solder from entering… that would be bad.

__ Put the board in your third-hands again with the channels on one side facing up. One by one, carefully flow solder into the open channels so that it fills them up and makes contact between the GPS pad's "half-moon" pads and the PC board. It only takes a tiny amount of solder… DO NOT OVERSOLDER. Some of the solder may flow down into the inevitable small gap that will be between the GPS module and the board… that's OK, in fact it's preferable because it will increase the contact area of the board and the module.



__ After all of the open channels have been soldered, gently heat up one of the resistor leads and remove it, then fill up the channel and GPS pad that was there. Similarly, remove the other resistor lead, and fill up that channel. Be sure to use enough heat so that the leads want to fall off the board… if you don't, you might lift the pads along with the leads!

__ Turn the board over, and repeat the procedure for the other GPS pads and PC board channels.



Now, all of the GPS pads and PC board channels should be soldered together. Remove the masking tape, and turn the board over on your table (yes, it will be upside-down).

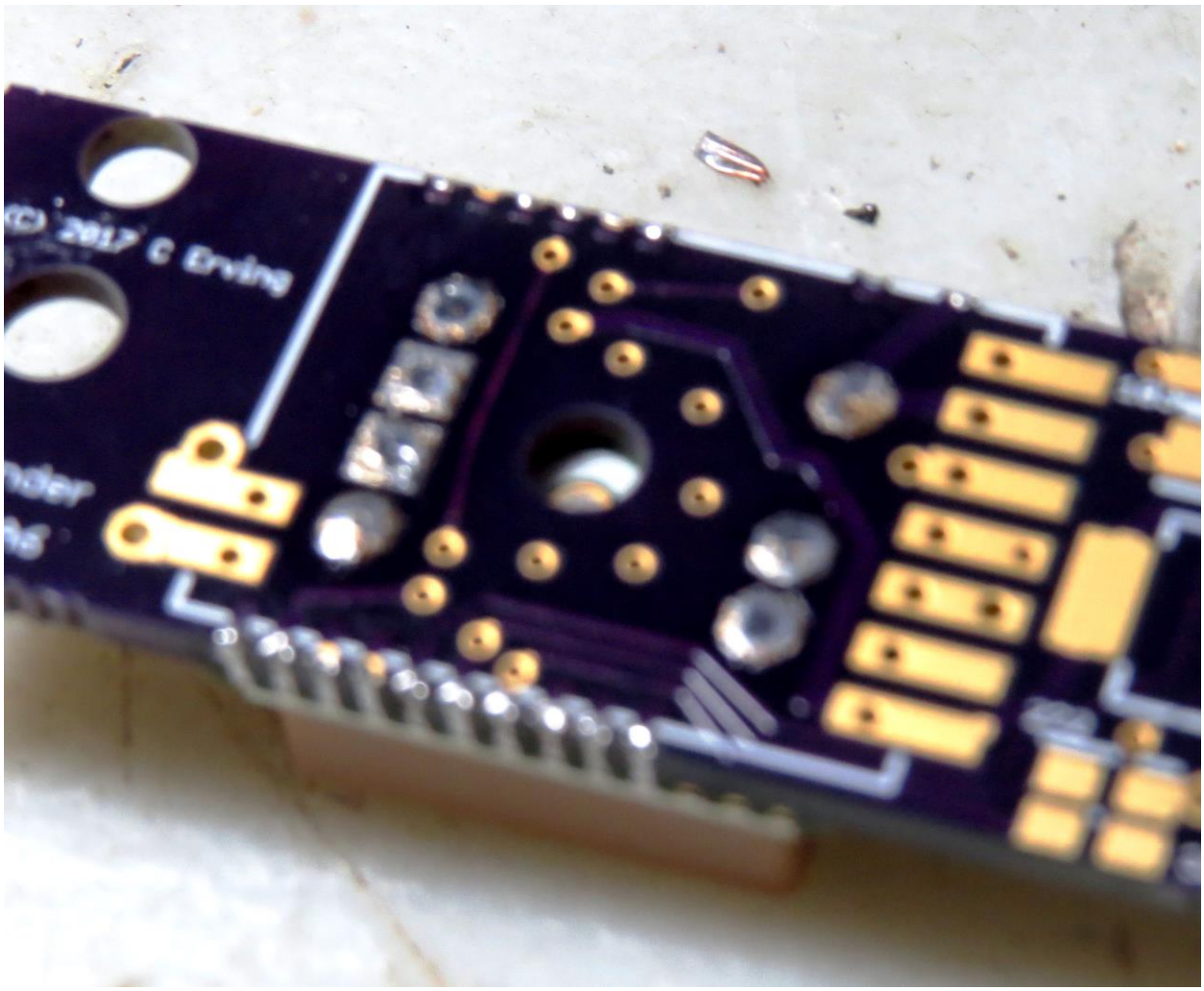
You will now be soldering the seven large pads on the bottom of the GPS module to the PC board. You will see that there are seven large pads with holes in the middle, these are aligned with the square pads on the GPS module. What you are going to be doing is to flow solder down those holes onto the pads, so that they are bonded to the board. Please read this procedure carefully BEFORE you start soldering, it is important that you do not overheat the pads on the GPS module.

__ Hold your soldering iron upright and gently slide it into the hole, hold it for about 5 seconds, then add some solder into the hole. As soon as the solder melts add a little more solder until the pad is just covered. The goal is to melt the solder down the hole onto the GPS module's pad underneath. The solder should flow down the hole and onto the pad underneath. After you remove the heat, the solder should "pop" down into the hole, this lets you know that solder is getting onto the pad. When you remove the soldering iron from the hole, wait 30 seconds, then inspect the hole with a magnifying glass or jeweler's loupe; solder should fill the hole. If the coverage appears to be incomplete, add a LITTLE more solder and reheat the pad for about 10 seconds, then let it cool down for 45 seconds before inspecting again.

__ Repeat the procedure for the other pads, numbered 2-7, in this order (the one that you did before was pad #1). Wait 30 seconds between pads to allow the GPS module to cool down.

1 5 3 7

4 6 2



__ Inspect all GPS module solder joints to make sure that they are nice and shiny, and that they properly bridge the GPS module pads and the PC board pads. Leave the board taped down to your work surface for now (GPS side down).

__ Take a break and get a beverage… you just completed the hardest part of building the kit!

Mounting the Resistors

The resistors are 0805-sized surface mount parts, yes they are very small. However, they're really not hard to mount, once you know the trick and you've done a few. They key is to follow the below-listed procedure exactly… if you do, you'll wonder why you ever thought that this was a such big deal.

1) Very lightly tin ONLY one of the resistor pads.

2) Holding the resistor with tweezers in one hand and your soldering iron in the other, center the resistor on the pads.

3) Once you have it where you want it, touch the tip of the soldering iron to the top of the resistor until the solder which you previously tinned the pad with melts.

4) Hold the iron for about 2 more seconds then remove the soldering iron, still holding the resistor in place.

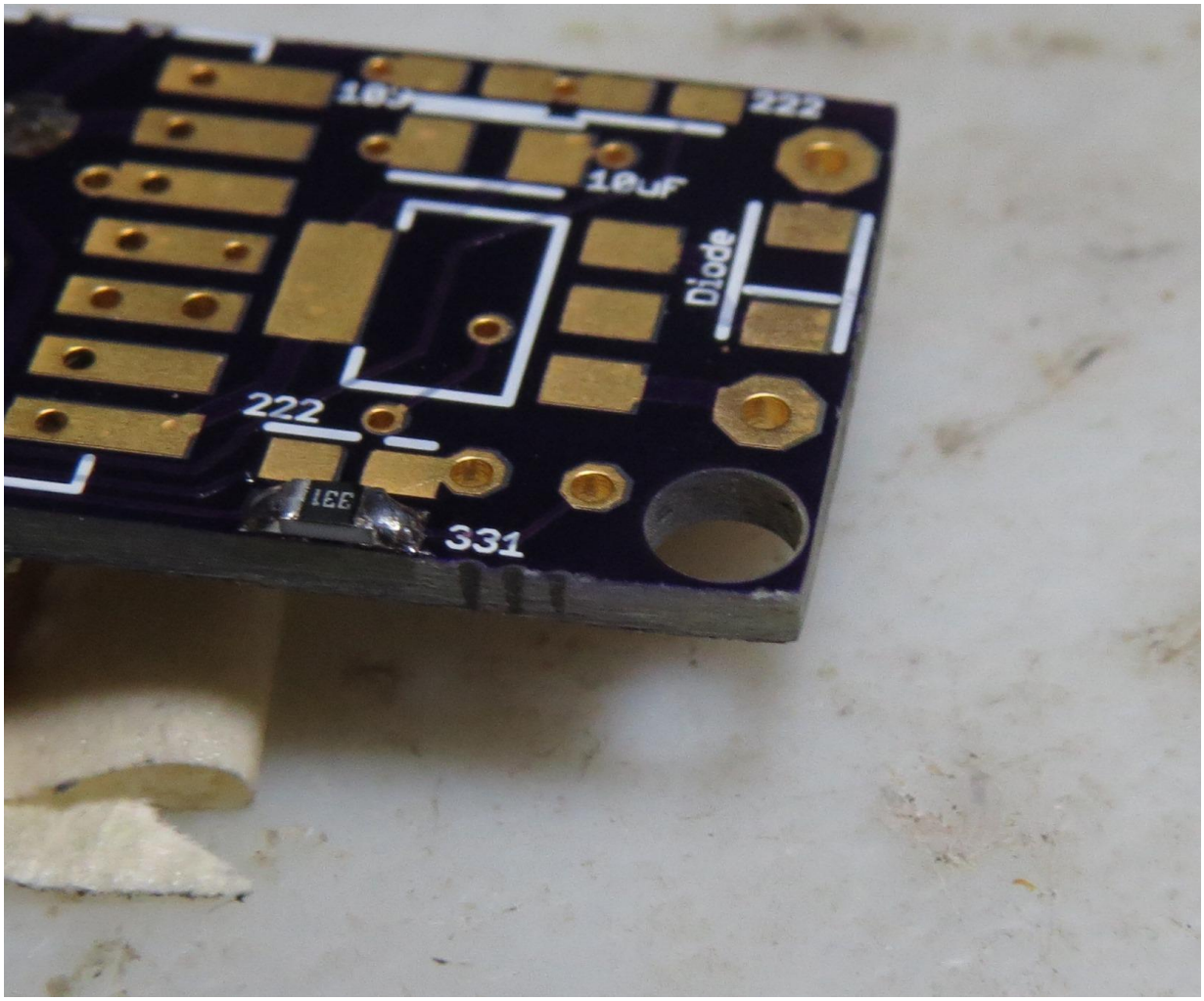
5) Wait about 5 seconds then let go of the resistor.

6) Now, solder the untinned pad to the resistor using only a tiny bit of solder, just enough to cover the pad and have it "wick" up the side of the resistor. This will take a very short time, so be ready to remove the soldering iron almost immediately. If you leave the iron on the resistor for too long, you may heat up the previously-soldered joint, and when you withdraw your soldering iron it will come off the board and stick to your tip, or it will "tombstone" and lay up on end. If that happens, heat up the joint, remove the resistor, and try again.

7) Inspect the joints, and heat/solder them if they don't look nice and shiny. You may end up resoldering the joint that you tinned originally, because chances are that it doesn't have enough solder to wick up the side of the resistor. If you do reheat the resistor, be careful not to overheat it; if you do, both solder joints may melt and you may end up lifting the resistor off the board.

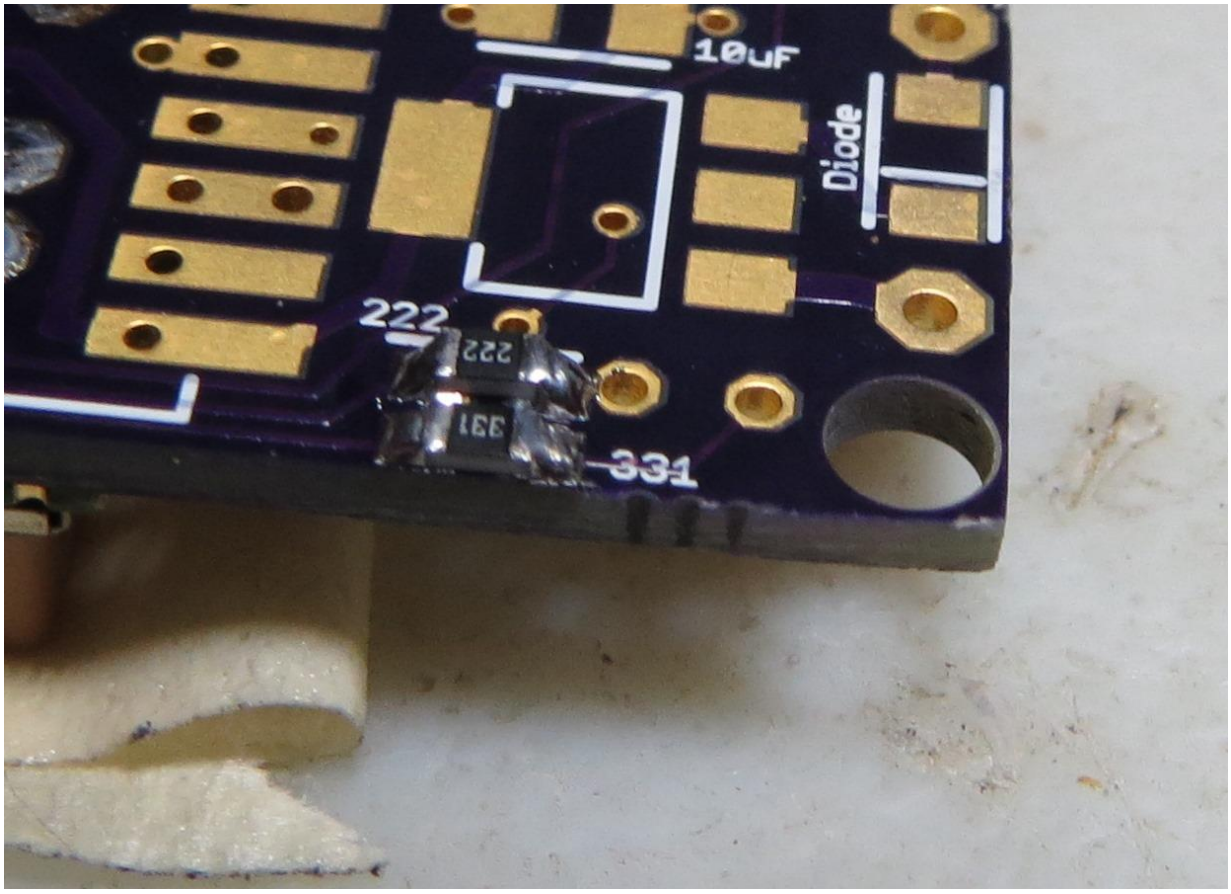
___ Mount the 330 ohm Resistor (marked "331")

Locate the 330 ohm resistor on the board, near the bottom right side of the board. Solder in place.



___ Mount the 2.2K Resistor (marked “222”)

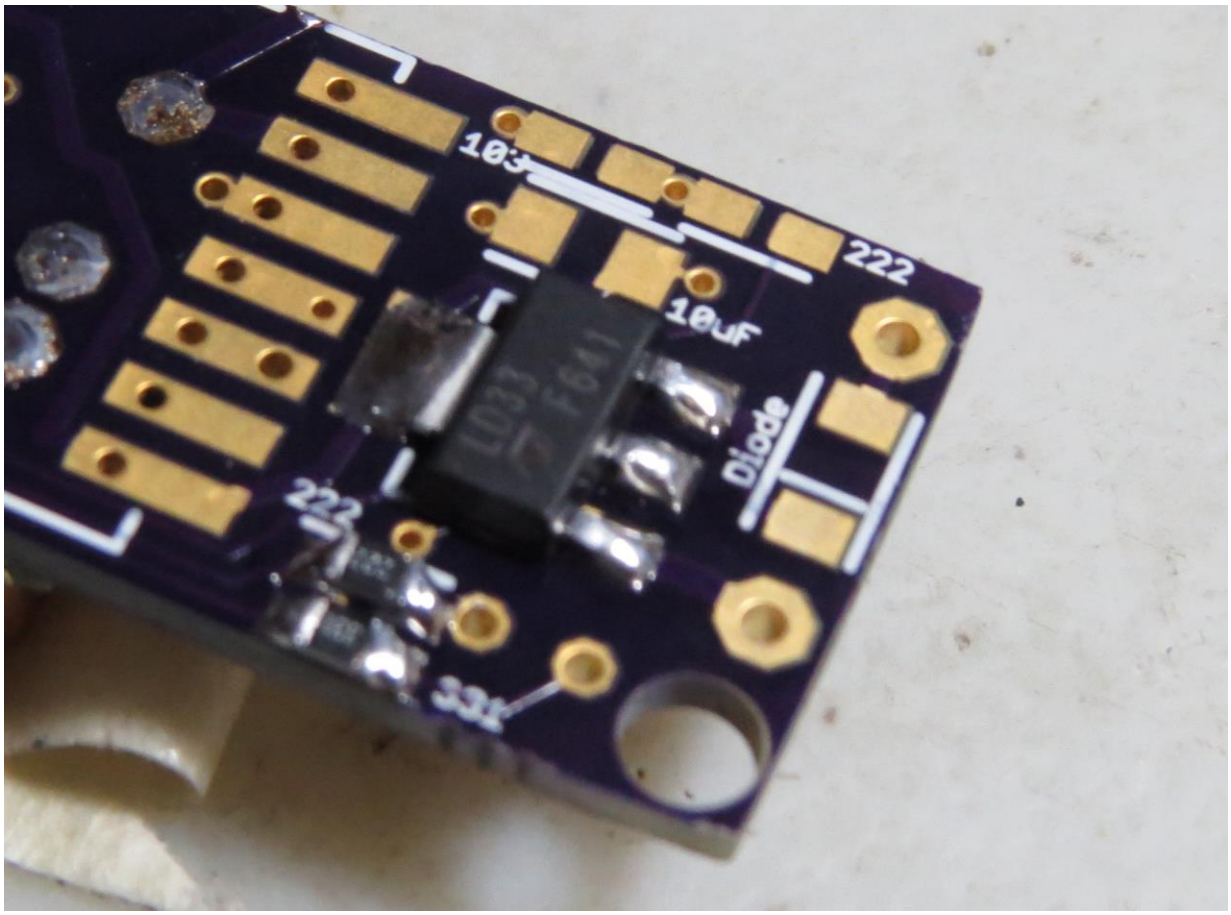
Locate the 2.2K resistor on the board, just above the 330 ohm resistor that you just mounted. Solder in place.



___ Mount the Voltage Regulator

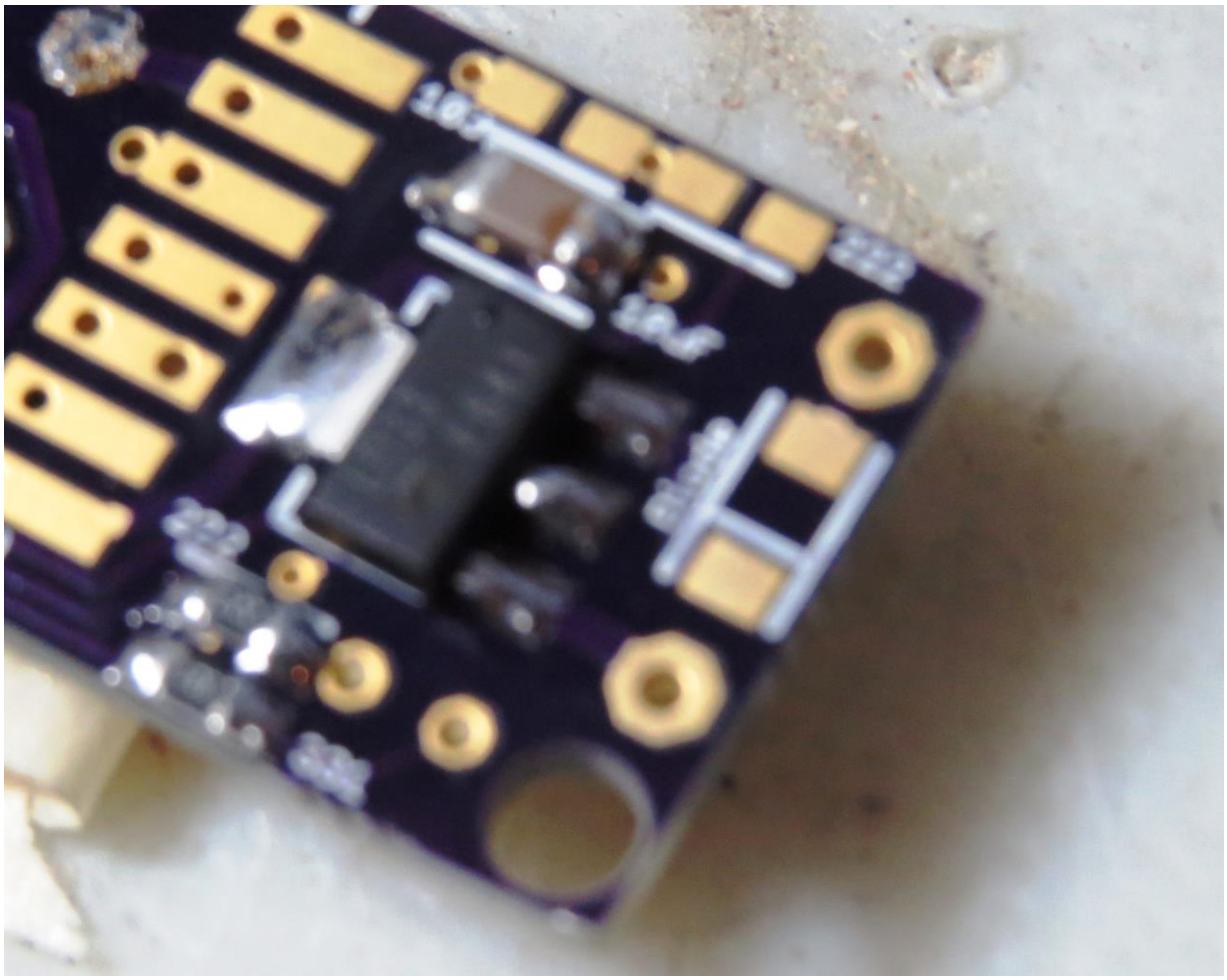
Locate the large pad and the three small pads for the voltage regulator. Heat up the pad with your soldering iron and flow some solder on the large pad, just enough to cover it. Place the voltage regulator IC in place, and hold it down, then heat up the large pad on the voltage regulator until the solder starts to flow. Hold your soldering iron on the pad for another 5 seconds, then remove it and wait at least 15 seconds. The large pad on the voltage regulator should be firmly bonded to the pad, if not then wait 30 seconds, heat it up again, until it is. You may have to apply a little more solder if you reheat it.

One by one, solder the three small three small leads to the pads, using enough solder to cover the pads, and making sure that there is enough solder to completely bond the leads of the voltage regulator. Wait at least 15 seconds between each pad to prevent the chip from overheating.



___ Mount the 10 uF capacitor

Mount the 10 uF capacitor onto the pads just above the regulator, it's marked "10 uF". It's a bit larger than the resistors, so you may need just a little more solder and heat to properly mount it.

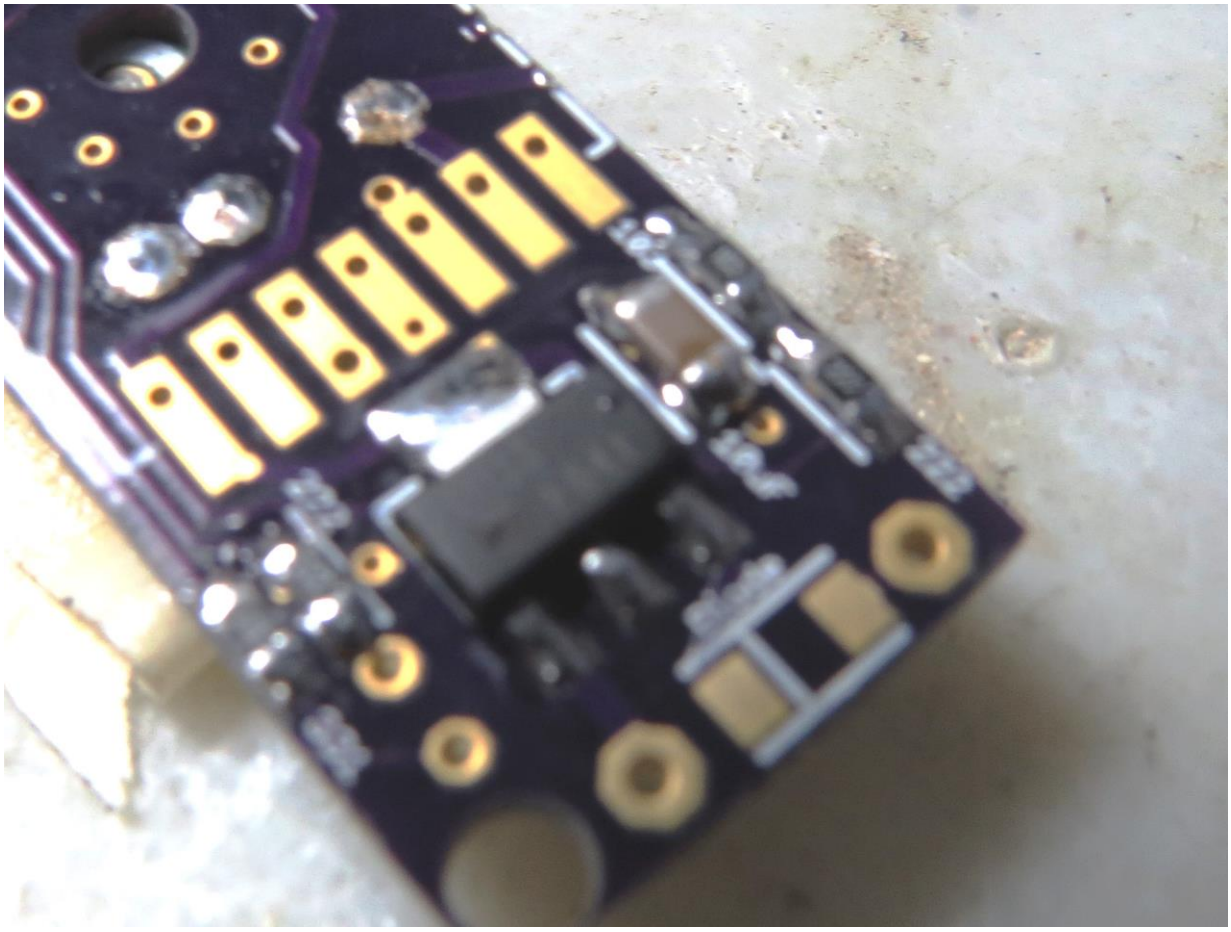


___ Mount the 10K resistor (marked “103”)

Locate the 10K resistor on the board, near the upper right edge. Solder in place.

___ Mount the 2.2K Resistor (marked “222”)

Locate the 2.2K resistor on the board, just to the right of the 10K resistor that you just mounted. Solder in place.

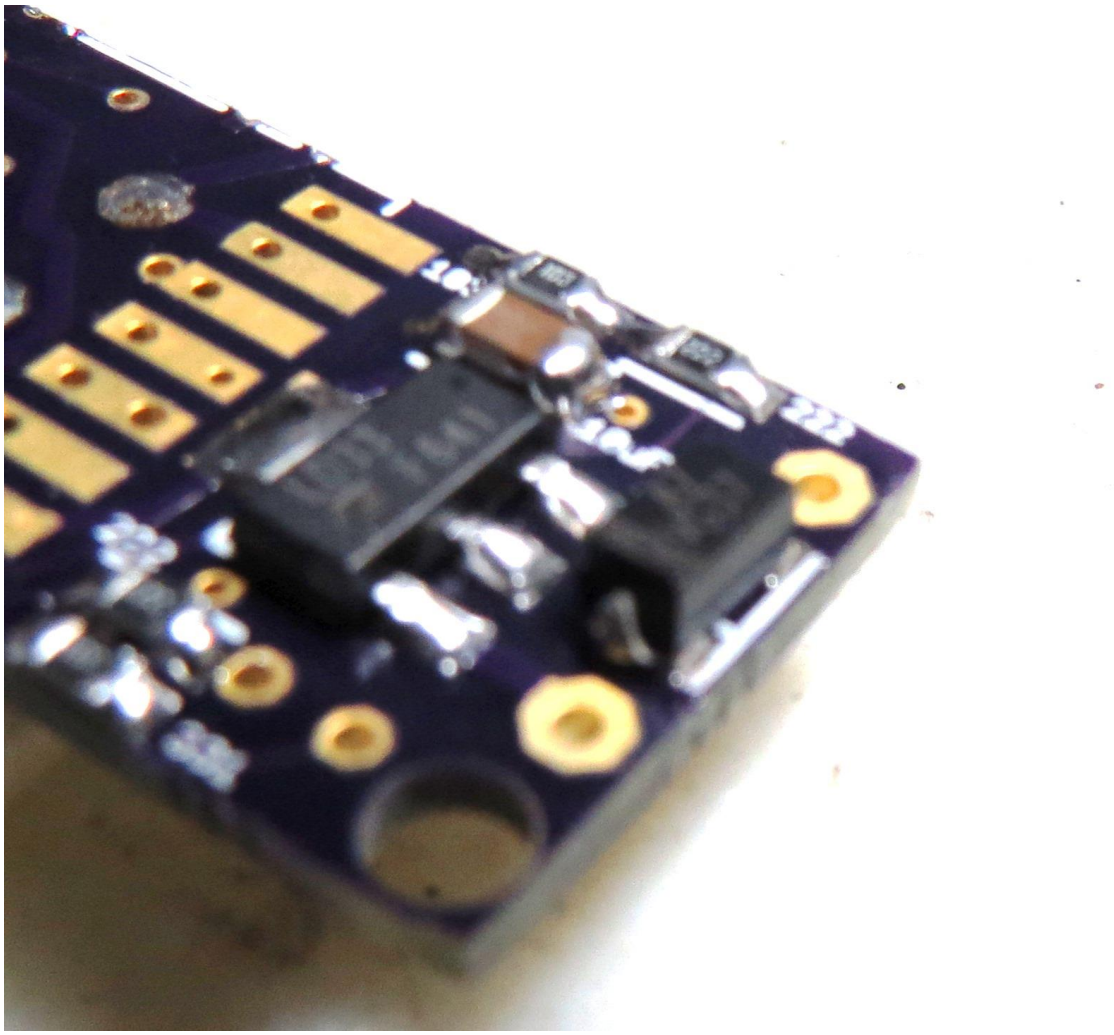


___ Mount the Diode

Unpack the diode from its package, if you look at it closely you'll see that one end has a stripe on it.

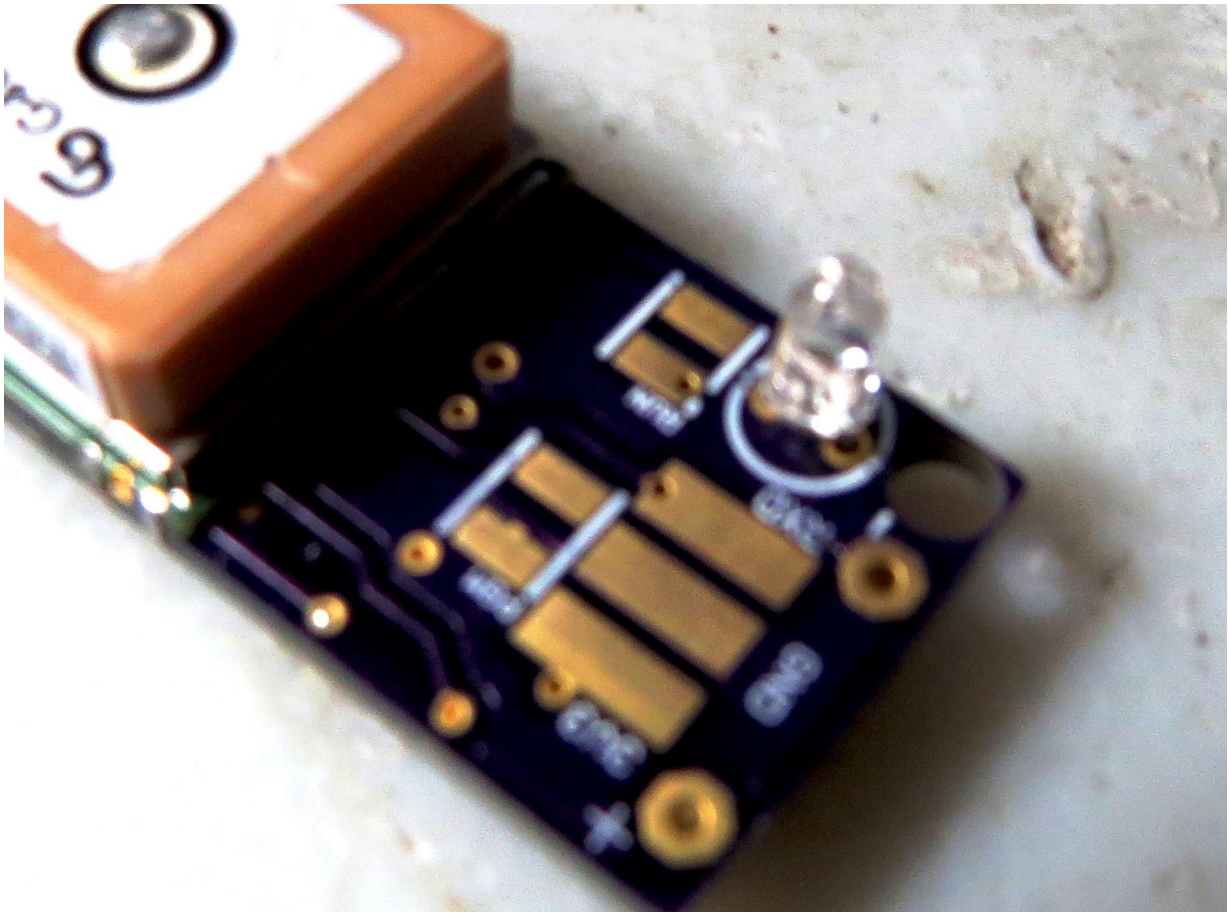
Locate the spot for the diode at the far right edge of the board, you'll see that one of the pads has a stripe right next to it. Tin BOTH of the pads lightly. Put a round toothpick in the "+" battery pad hole, to prevent solder from getting into it. The diode comes very close to the hole, so this is highly recommended.

Solder the diode in place, matching the side with the stripe up with the stripe on the board. Yes, the side without the stripe slightly overlaps the "+" battery pad… it's OK if you get a little solder on it, but be careful not to get any in the "+" pad's hole. Note that if you get this wrong, your Eggfinder Mini will not power up at all, so double-check before you solder!



___ Mount the AMBER (1S) LED

Turn the board over. Insert the AMBER LED into the holes for the 1S LED, make sure that the LONG lead is in the hole maked "+". Note that it may actually be clear. Turn the board over and solder the leads to the board. Trim the leads flush. Save the cut-off leads, you'll need them for the next step.



Mounting the Hope RF Radio Module

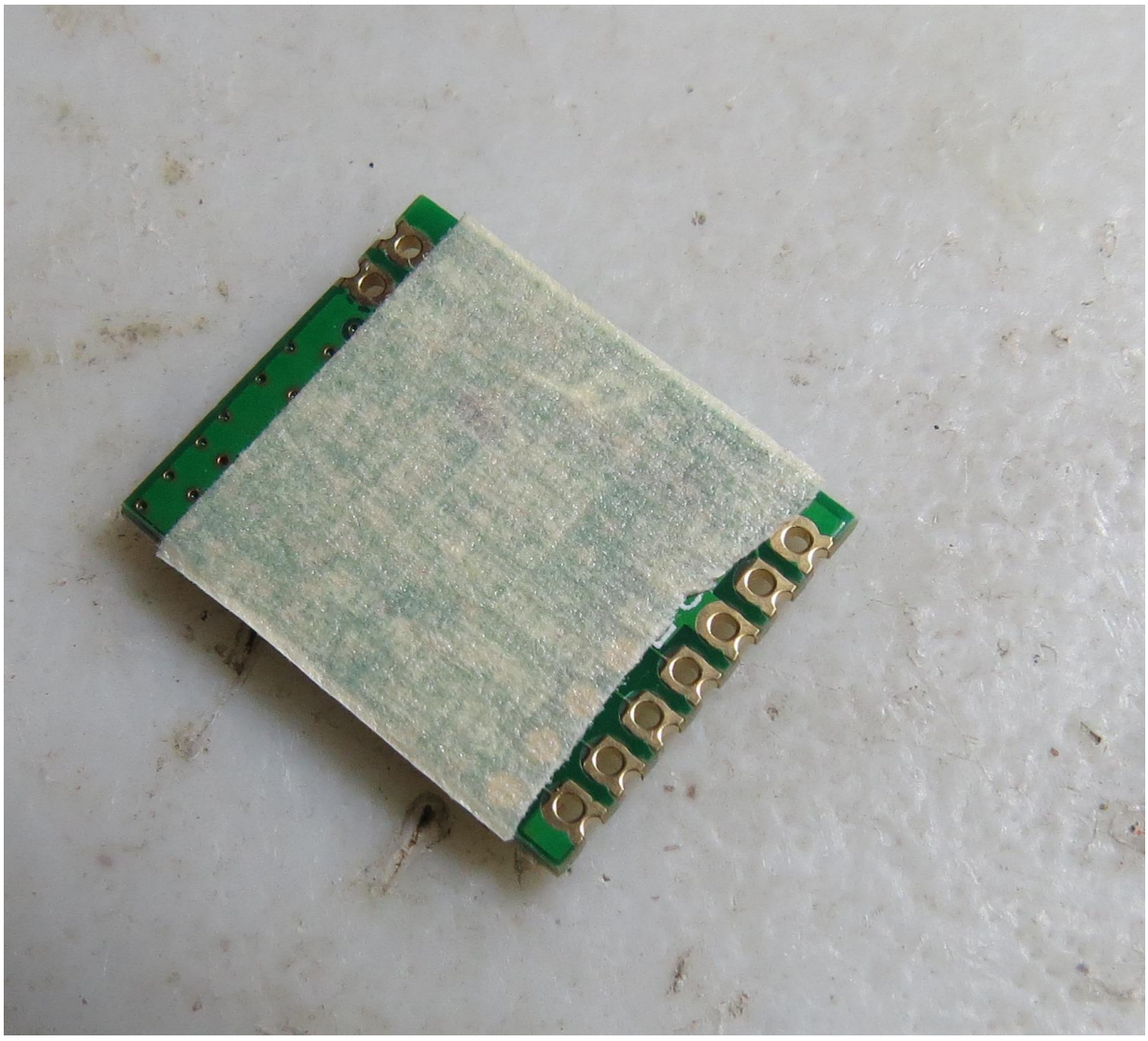
You will be surface-mounting the Hope RF radio module to the board, similar to the GPS module. The pad spacing is larger, and the part itself is lighter, so it is much easier to solder. There are no pads on the bottom either, so it should be a breeze once you've mounted the GPS module.

__ With a piece of paper masking tape about 2" long, tape the board to your work surface so it won't move.

__ Cut another piece of masking tape about 1" long and about 16mm wide.

__ Carefully cover the BOTTOM of the Hope RF module with the masking tape, covering everything except the pads at the end with the holes in them. It's 16mm between the inside ends of the pads, so if you cut the tape correctly the tape should fit nicely. Trim the excess tape at the side of the RF module so it's flush.

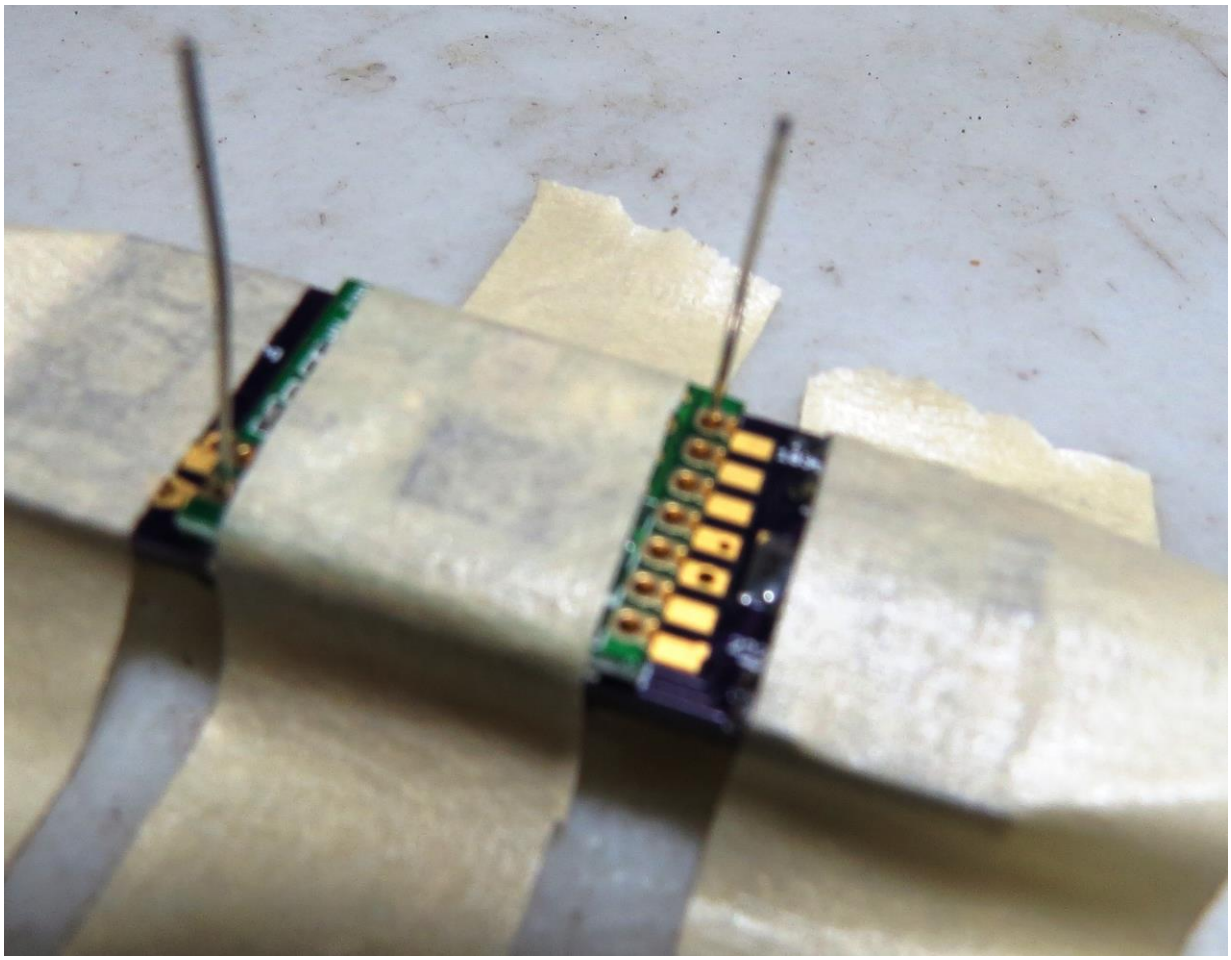
If you do this right, the only part of the module that should be exposed are the seven pads on the one side, and the two pads on the other (plus a bit to the side of those two pads, that's OK). This provides electrical insulation from the exposed GPS module ground pads, so this is a very important step… make sure it's right!



__ Carefully position the Hope RF module on the board so that its pads line up in the center of the top pads, the “half-moon” cutouts on the module should be centered on the pads on the board. Make sure that it’s properly positioned, there are some small holes on the pads on the module, they should line up with similar holes on the board. Use the cut-off LED leads to line up the module, put one in each corner to line it up (you won’t be soldering them in, they’re just for alignment).

__ Cover the TOP of the module with masking tape, then tape the module down.

It is important that the masking tape covers as much of the RF module as possible, up to the exposed pads. This is to prevent any errant solder splatter from getting onto the RF module, since the SMT parts on the module are exposed. There are some VERY tiny exposed parts on the RF module, if you get the tiniest bit of errant solder on the module chances are excellent that it will be ruined.

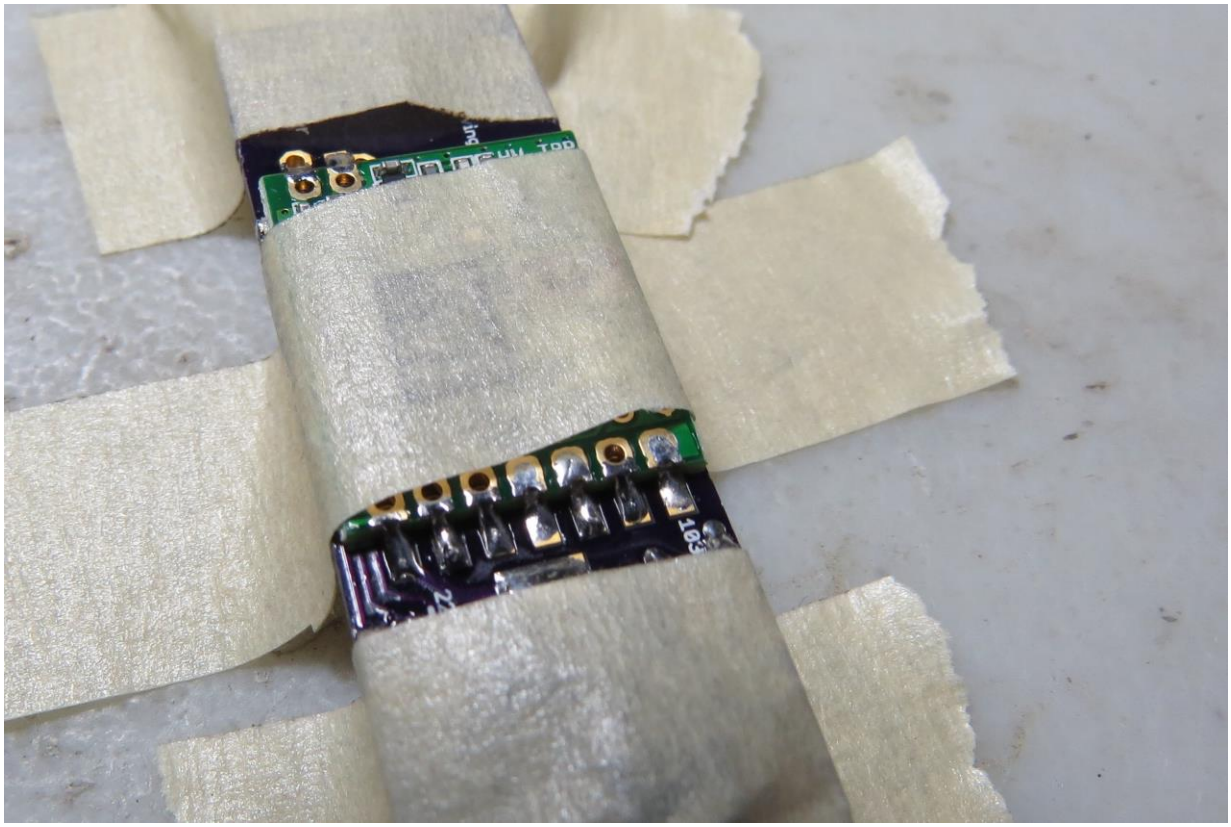


__ Solder the second pad from the top-right of the Hope RF module to the board (the one NEXT to the positioning lead). Make sure that the board is properly positioned after you solder this joint; it it moves, heat up the solder joint and move the board slightly so that it is properly positioned. Wait 30 seconds after soldering before continuing.

__ Solder the pad on the left side that does NOT have the positioning lead in it.

__ Remove the two positioning wires, then solder those pads.

__ Solder the remaining pads to the board, waiting 30 seconds between pads to prevent the module from overheating.



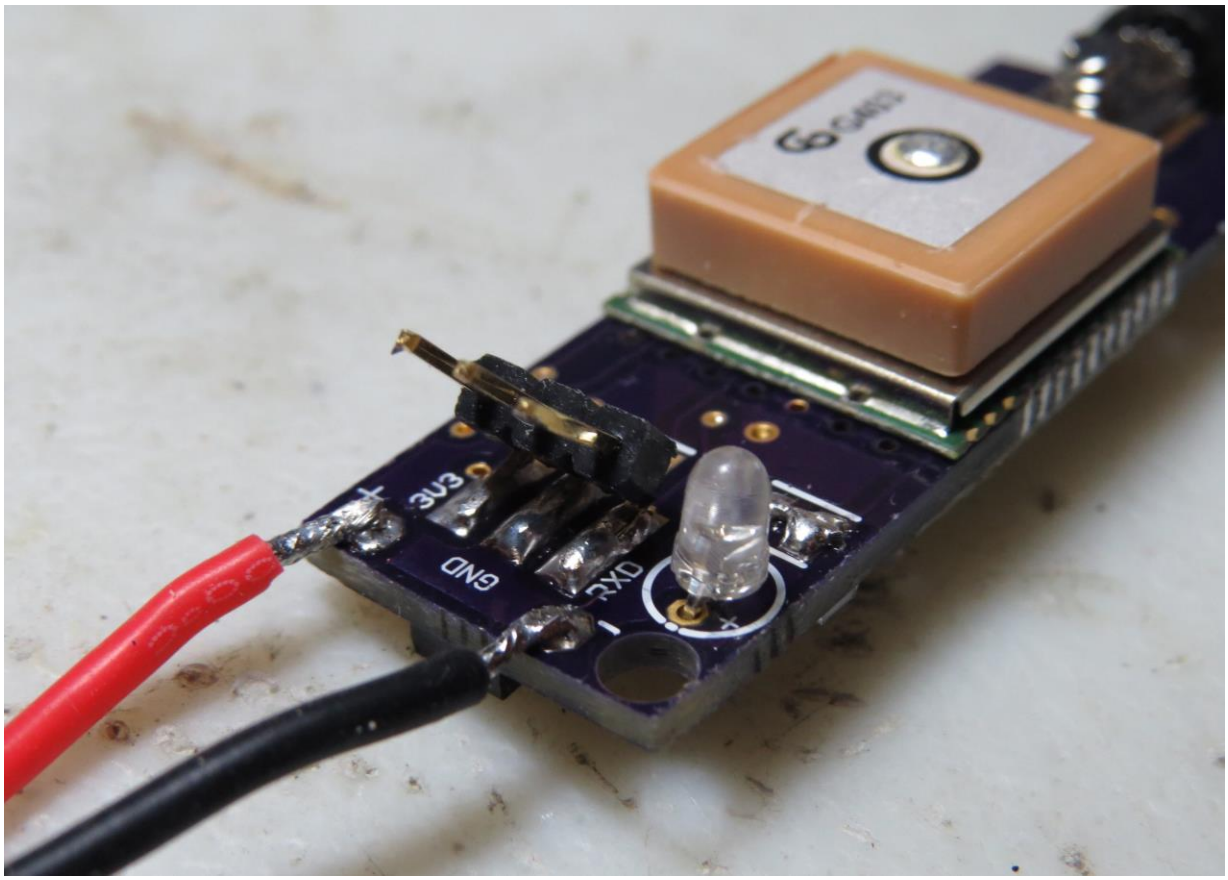
Final Assembly

At this point you're almost ready to go, but not quite. You need to make sure it works first.

__ Create a solder bridge between the two pads next to the LED marked "RUN". It may take a bit of solder, so don't be shy… they need to be connected together. You can also use a small piece of wire or a piece of the discarded resistor lead to bridge them. You may find this easier to do if you bend the wire into a "L", so you have something to hold the wire by while you solder it.

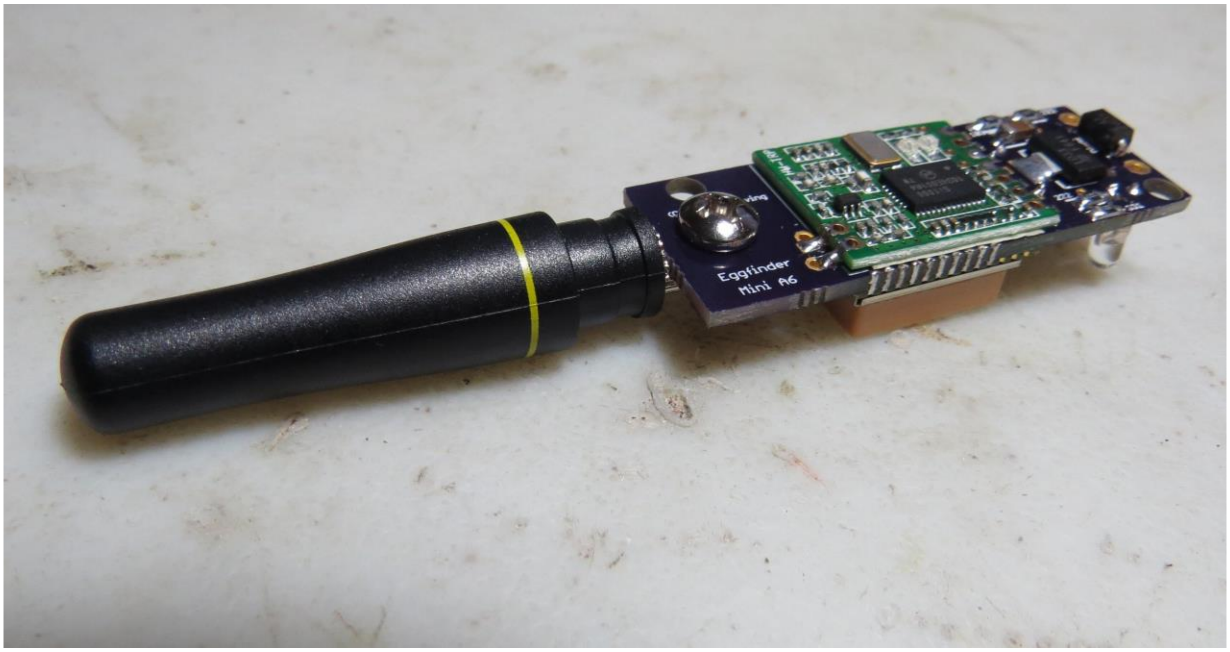
__ Clip off one of the header pins so that there are three. Bend the LONG pins inward 45 degrees, in the direction of the right-angle leads. Clip the right-angle leads about half-way to shorten them.

__ Generously tin the center of the three large pads next to the LED. Hold the bent header with tweezers down against the three pads so that the large pins are tilted towards the edge of the board, then heat up the tinned pad so that the solder flows around the clipped center pin. Let it cool for 10 seconds before you let it go, then generously solder the two other pins and touch up the center pin as necessary.



__ Solder your battery connector to the two pads near the edge of the board marked "+" and "-". Make sure that there are no stray wire "whiskers" touching the board.

__ Put the screw for the antenna through the RF module side of the board, and mount the antenna on the GPS side of the board. Note that the antenna's mount is offset a little bit, the larger side should go on the GPS module side of the board. Make sure that it's pointing straight, and that the screw is tight. If you wish, you can use some Loctite on the screw, the screw itself isn't the electrical connection to the antenna, it's the large exposed pad on the GPS module side.



~~~~~~

Assembly of your Eggfinder Mini is now complete. Inspect the board carefully, looking for "cold" solder joints or incomplete solder joints. Cold solder joints appear dull instead of shiny, and may appear as blobs of solder and not have the nice "wetting" of the pad that you will see with good joints. A magnifying light is good for checking the board. We do not recommend using flux remover or other cleaners on this board, as they may not be compatible with the no-clean flux in the solder.

Powering your Eggfinder Mini

The Eggfinder Mini requires 4.5V-9V, with a nominal working current of about 70 mA. However, when first powering up it may have peaks of up to 200 mA as the GPS module acquires satellites. For this reason, we recommend that you use a 7.4V 2S LiPo battery pack; just about any one you buy will have enough capacity for run your Eggfinder Mini board for at least two hours. A 300 mAH 7.4V 2S LiPo is ideal, it's a little smaller and lighter than a 9V battery and will easily power your Eggfinder Mini for over 4 hours. If you have a big rocket and can afford a little more weight, a 800 mAH 2S LiPo will run your Eggfinder for the whole flying day, which can be handy for those times when your main parachute comes out at apogee and your rocket drifts several miles away. (Yes, we've done that…)
~~~~~~

Since the Eggfinder Mini lends itself towards temporary mounting (such as in an 18mm body tube or being put into a piece of Kevlar shock cord protector sleeve) and being put into really skinny rockets, you may want to use a smaller battery. If you have a 38mm minimum-diameter rocket, a 200 mAH 2S LiPo works fine, and it's quite small. We've also seen some 300 mAH batteries that are relatively square, and actually fit in an 18mm tube.

We do not include a battery connection cable because there are several different ones that you may use, depending on your battery. Most 2S LiPo batteries have a "JST" connector, so it is very common to use a JST female "pigtail" on the board.

Since the Eggfinder Mini is turned "on" by connecting the battery, there's really no reason for a power switch, as long as you have a removable battery connector. It's desirable to keep it powered up, since that will maintain the satellite "fix"; the location of the satellites is volatile, and is erased when you removed the power. See the Eggfinder User's Guide (in the Eggtimer Rocketry web site, www.EggfinderRocketry.com) for tips on using it in flight. If you're using the Eggfinder LCD receiver (which we HIGHLY recommend), see the Eggfinder LCD User's Guide… everything that applies to the Eggfinder TX also applies to the Mini, including the frequency programming section.

Testing Your Eggfinder Mini

To test your Eggfinder Mini, first connect the battery. The red light on the RF module should immediately start blinking. (If it does not, immediately unplug the battery and go to the Troubleshooting section). The GPS module begins its startup sequence, and causes it to start looking for satellites. The GPS module will begin transmitting status data immediately, you should see the small red LED on the RF module blinking approximately once per second as the data is sent out. It will take anywhere from 10 seconds to a few minutes for the GPS to acquire enough satellites to begin sending out valid latitude and longitude data, when that happens the 1S (AMBER) light will begin flashing on and off once per second. This could be as long as 30 minutes if you are testing it indoors, so be patient. Once that happens, get out your Eggfinder receiver and make sure you can get a fix. If you get one, congratulations! If not, time to start troubleshooting.

If you don't have your Eggfinder LCD receiver built yet, build it and come back…

If you do, turn it on, set it to 915 MHz/ID=0, and see if you get a fix. If the orange LED on the Eggfinder Mini is blinking, you should see a fix on the LCD receiver almost immediately. If it stays on "Waiting for Fix" AND the green LED on the Eggfinder LCD receiver's RF module is blinking, that means you need to resolder the GPS module pads on the side…

If you DO get a fix, congratulations! You're done. There's one more step we recommend, though…

Shockproofing Your Eggfinder Mini

The Eggfinder Mini is small and light and can take quite a beating from things like hard landings and VMax motors, however there is one component that is vulnerable… the GPS antenna, that brown square on top of the module. We STRONGLY recommend that you glue it down to the metal shield using a thin bead of a high-quality non-conductive epoxy like RocketPoxy or West Systems. Don't use the cheap hardware store epoxy, and DO NOT use JB Weld… it contains metal particles and can detune the GPS antenna and reduce its performance. It doesn't take much, a couple of drops of epoxy spread between the base of the antenna and the shield should do it. Try not to get it on the solder pads, in case you have to resolder them at some point later on (not likely, but not unheard of either).

The kit includes some clear heatshrink tubing, this is to cover the GPS module's exposed pads (those channels on the side that were so much fun to solder…) to protect them from abrasion if you decide to put it in a pouch of some sort in your body tube. Slide it over the board so that it goes from the antenna side of the board to just past the GPS module, then shrink it in place with a heat gun on LOW. You want to do this AFTER your epoxy cures… typically the next day.

We also recommend that if you're putting your Eggfinder Mini in a pouch that you zip-tie the power wires to the unused screw mount at the back of the board, and use some kind of soft adhesive (such as RTV silicone or hot melt glue) to tack the wires to the pads so they won't get bent and break off due to stress.

Troubleshooting

If your Eggfinder Mini doesn't work after assembly and testing, take a deep breath, get out a beverage to clear you mind, and start troubleshooting…

Check Your Solder Joints

The very first thing you should do is to check out all of the solder joints under a lighted magnifier. The most common reason for things not working are solder bridges, i.e. putting too much solder on the pads and shorting two adjacent pads together. You can also get into problems by bridging pads with "vias" on the board, the smaller holes that don't have any components soldered to them. Also, the pads on the GPS module are small, so you want to make sure that you got just enough solder on them to bond the module to the pads. Most of the pads are very small, so it doesn't take much solder to get a nice "tented" solder joint. If you get a solder bridge, heat it up and use a solder wick or a vacuum bulb to remove the excess; afterwards, we recommend resoldering the joints. Note: NEVER use "canned air" or compressed air to "blow away" excess solder. The resulting splatter will almost always cause more damage than the original solder bridge, and if you get solder splatter on the RF module or inside the GPS module, there's no way to fix it.

Another thing to look out for is "cold" solder joints, they look dull and blobby compared to a nice shiny "tented" solder joint. If you have a cold solder joint, it won't conduct well; at the low power that the Eggfinder Mini uses this could easily keep things from working. If you have a cold solder joint, heat it up and put just a little bit of solder on it, the main idea is to get a little more flux on the joint. If there's too much solder, use a fine solder wick or (preferably) a vacuum bulb to remove the excess, then heat it up and resolder the joint.

Check Your Component Polarity

Most of the through-hole components aren't polarized, with some notable exceptions. The outline of the parts is silk-screened on the board, so you should be able to see readily if you have a component soldered in backwards.

If the amber LED is backwards, the little red LED on the RF module will blink, but the amber LED will never come on. Once you clip the lead, it's difficult to tell what the polarity is, so it's better to make sure that you get it right the first time.

Similarly, if you get the diode backwards, the board won't work at all. Be sure to match up the stripe.

If you inserted a component incorrectly, you will have to carefully unsolder it, clear any solder residue from the holes, and resolder it. If you find that a component was soldered incorrectly, you will have to use a vacuum bulb or vacuum desoldering tool to unsolder it. We cannot stress enough that you need to check the orientation of the parts ***before*** you solder them. The Eggfinder Limited Warranty does not cover damage to a component while attempting to unsolder it, so make take your time and make sure you get it right before you solder.

Check Your Power Supply

Make sure that you are using one of the recommended batteries to test with. A fresh 9V alkaline battery is OK for testing, but we do NOT recommend flying with one; they just don't have enough capacity, and you're likely to get only an hour or so of use out of one.

If It Still Doesn't Work…

There is, of course, always an outside chance that you have a bad component. We test each PC board and the surface mounted components before they leave us. Nevertheless, it is always possible that something may be wrong; there may be a bridge on the PC board itself, etc. If you have gone through all of the troubleshooting steps and the board still doesn't work, let us know at support@eggtimerrocketry.com . A high-resolution picture (5 megapixel or better) of both sides of your circuit board and a description of the problem would be very helpful…

Troubleshooting Tips (in approximate order of likelihood)

RED LED on the RF Module Doesn't Blink at Power-Up

• Bad solder joint on GPS module "somewhere" (#1 reason for this!)
• Bad solder joint on 2nd pad from the bottom of the left side of the GPS module
• Bad solder joint on the 5th or 6th pads from the bottom of the left side of the GPS module
• Bad solder joint on the 5th or 7th pads from the bottom of the right side of the GPS module
• Bad solder joint on the 4th pads from the bottom on either side of the GPS module

…you get the gist of this… the GPS module pads are ALL important…

• Solder bridge on GPS module pads
• Bad solder joint on 10K or 2.2K resistors next to GPS module
• Missing/loose shorting jumper on the RUN header
• Bad solder joint on battery connector pads
• Bad solder joint on voltage regulator
• Backwards diode
• Bad solder joint on 10 uF capacitor
• Solder bridge "somewhere" on the board… time to go hunting with a lighted magnifier

AMBER LED doesn't flash, but RED LED on RF module is flashing

• Very weak GPS signal, try it outdoors
• Few satellites in view, let it run for about 30 minutes
• Bad solder joint and/or bridge on GPS module
  (in particular, the 5th & 6th ones from the bottom on the left,
  and the 5th & 7th ones from the bottom on the right)
• Bad solder joint and/or bridge on the 10K resistor
• Bad solder joint and/or bridge on the 2.2K resistors
• Amber LED is backwards
• Bad solder joint and/or bridge on Amber LED
• Bad solder joint and/or bridge on 330 ohm resistor

Can't Get a Fix on the Receiver

• Very weak GPS signal, try it outdoors
• Few satellites in view, let it run for about 30 minutes
• Receiver frequency/ID doesn't match
  (Is the green LED on the receiver's RF module blinking?)
• Bad solder joint and/or bridge on GPS module
  (in particular, the 5th & 6th ones from the bottom on the left,
  and the 5th & 7th ones from the bottom on the right)
• Bad solder joint and/or bridge on the 10K resistor
• Bad solder joint and/or bridge on the 2.2K resistors

Programming the Frequency on your Eggfinder Mini

Eggfinder Mini's are shipped with a default frequency of 915 MHz (unless you specified otherwise when you ordered it, or it's an AUS/NZ version). You can change the frequency of your Eggfinder Mini so that if you find that other flyers are using the same frequency there isn't a conflict. To do this, you'll need an Eggfinder LCD Receiver. There are a total of 9 base frequencies and 8 ID codes to choose from, so up to 72 Eggfinders can be running at the same time.

We STRONGLY recommend that if you do nothing else, you change your Eggfinder Mini from the default frequency, since if you do not there is a good change that somebody else will have one on "your" frequency.

Changing the frequency on the Eggfinder Mini requires some minor soldering, so you probably won't want to do this in the field… you should do it BEFORE you go out to fly. If you do want to do this in the field, you'll need a small portable soldering iron… Weller makes a little battery-powered portable iron that uses four AA batteries, it works great for small jobs like this and it won't fry the board by getting too hot. It's part number BP865MP, they're around $20.

To change the frequency:

• Unsolder the shorting bridge across the "RUN" pads.

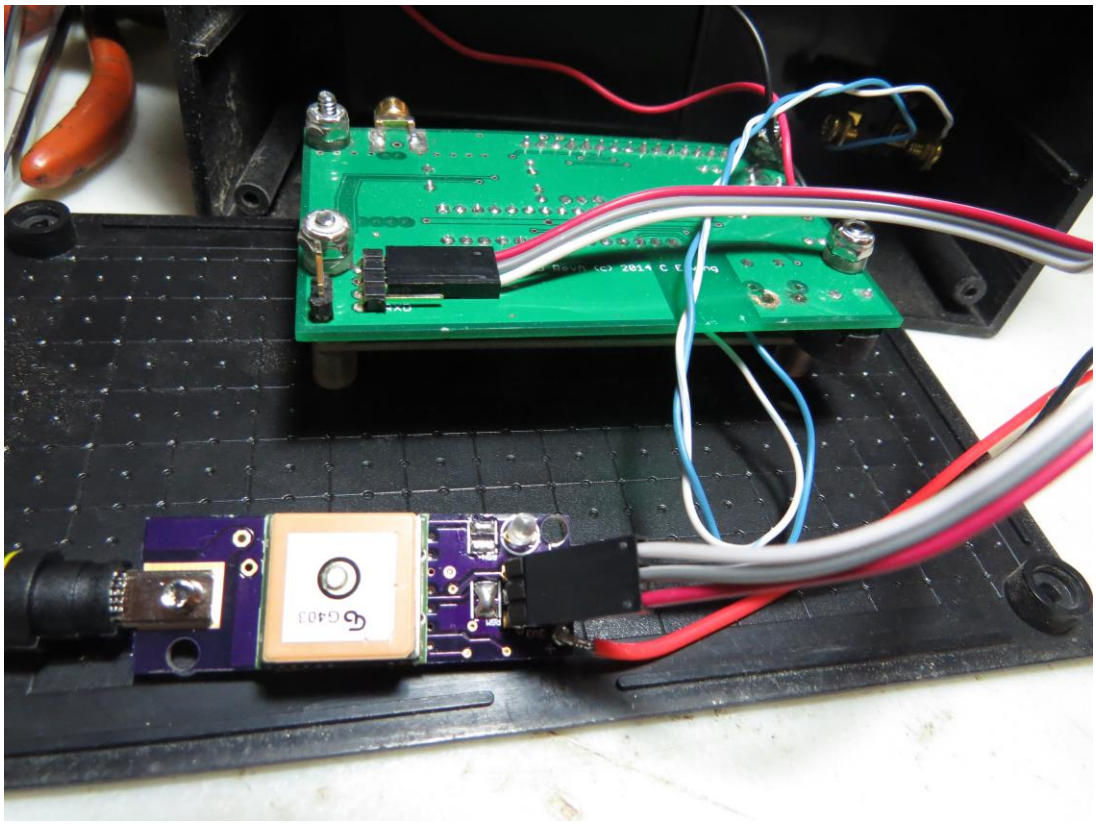
• Solder a bridge across the "PGM" pads, like the one you had on the "RUN" pads. You may want to use a small piece of wire to make this easier.

• Do NOT connect a battery to the Eggfinder Mini… it will get its power from the LCD receiver.

• Open up the case on your LCD receiver, and make sure the power is OFF.

• Connect the programming cable to the Mini & the LCD receiver…

Plug the 3-pin programming cable into the 4-pin header on the LCD receiver, so that the 3.3V, GND, and TXD pins are connected. Plug the other end of the cable into the Mini's header, MAKING SURE THAT THE 3 WIRES ARE CONNECTED TO THE SAME PINS ON BOTH THE MINI AND THE LCD. DOUBLE-CHECK BEFORE CONTINUING! See the picture below.



• Turn on the LCD receiver's power… the Mini should also come on with BOTH the RED and GREEN LED's on the RF module lighting up. If it does NOT come on like this, immediately turn off the LCD's power and check your connections.

• At the LCD's status display, hold the button down for 3 seconds then release it to put it into programming mode.

• Follow the frequency programming instructions found in the Eggfinder LCD Receiver User's Guide. When you program the frequency on the LCD receiver, the Eggfinder Mini that's connected to it will also be programmed to the same frequency and ID code.

• Turn off the LCD receiver, disconnect the programming cable from the LCD and the Mini.

• Unsolder the bridge across the PGM pads, and resolder the bridge across the RUN pads.

• Power on the Mini, the RED LED on the RF module should start blinking.

• Power on the LCD receiver, the GREEN LED on the RF module should start blinking in sync with the RED LED on the Mini. This means that they are now on the same frequency/ID.

• Wait a few minutes until you get a fix to confirm that everything is working before flying. Note that if you're doing this indoors, it could take awhile… be patient.