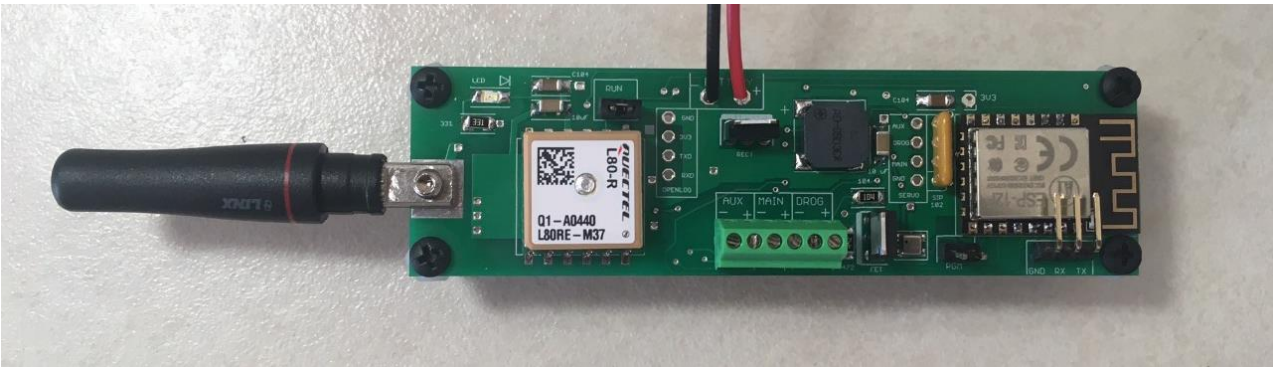
Eggtimer Quasar
WiFi-Enabled Flight Computer
w/GPS Tracking
Assembly Manual

Board Rev G3



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
(For unlicensed bands)

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.

Contains FCC ID: 2AHMR-ESP12F

The Eggtimer Quasar uses an ESP8266-12 801.11n WiFi module in the 2.4 GHz unlicensed band, and a Hope RF HM-TRP transceiver module, per FCC part 15. It is intended to be used only in the United States or other countries in which this band (or a subset of it) is not subject to licensing. 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 not modifying the WiFi module in any way.

Because the Quasar 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 Quasar is unlikely to be significantly affected by outside radio sources, but there's no guarantee.

If your Eggtimer Quasar 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 in particular the distance from any population 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 and unintentional emitters)
http://www.ecfr.gov/cgi-bin/text-idx?SID=adb12f74b498e43ec453f7899d9df0fd&node=47:1.0.1.1.16&rgn=div5

FAA Regulations for Amateur Rocketry (Part 101)
https://www.ecfr.gov/current/title-14/part-101

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Before You Start…

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

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

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Thanks for buying an Eggtimer Quasar! The Quasar integrates a 3-output flight computer, a GPS radio tracker, and data logging/telemetry into a single device. Typical range with the recommended Eggfinder LCD receiver is over six miles… if you have a Ham license and opt for the 70cm version, you can expect twice that range.

The Quasar uses a simple WiFi/browser interface so you can program, arm/disarm, test, and download your flight data all from your handheld device. It will work with virtually any wireless device, no apps or other special software required... it uses the browser that you device already has. You can monitor the battery status and the continuity of your deployment channels, all from over 100' away typically. Each Quasar has a unique WiFi SSID code, and it uses the WPA2-PSK connection protocol with a unique 8-digit passkey, so it's almost impossible for anyone except yourself to connect to your Quasar and turn it on (or off!). To arm your Quasar you need to enter a 4-digit validation code that changes every 60 seconds or whenever you refresh the web page. This prevents it from being accidentally armed or disarmed… you wouldn't want to "pocket arm" your altimeter!

During your flight, using your Eggfinder LCD receiver you can get real-time altitude and deployment channel status, along with the GPS data from your rocket It will tell you the compass direction and distance to your rocket in flight, and if you have the optional LCD-GPS module for the Eggfinder LCD receiver it will also perform the navigation to your rocket. You follow the arrow, and it will lead you right to your rocket.

After your flight, you can view summary flight data right on your handheld device, and you can also download a csv-formatted detail file to your device for analysis using a spreadsheet or other program. It holds your last 15 flights, and numbers each one so you know which one is which.

Finally, you can also perform a full-blown deployment test, from over 100' away, without having to worry about several grams of BP going off in your face.

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 this, 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!).

About Batteries for Your Quasar…

The Eggtimer Quasar was designed with 2S/7.4V LiPo batteries in mind. Under some circumstances, the Quasar can use over 250 mA of current, so we recommend that you use a battery with at least 500 mAH of capacity. The average current draw is closer to about 180 mA. A 500 mAH battery will give you about 3 hours of power, which should be enough for almost all flights. Bigger is better. You CAN use a smaller LiPo battery, just remember that the run-time will be less, so if you put a 200 mAH battery in your AV bay and it sits on the pad for two hours, you may have an unpleasant surprise if your battery runs down before your flight. Fortunately, it's easy to remotely monitor the battery voltage of your Quasar, so this shouldn't happen.

Regarding the battery voltage monitor, the Eggtimer Quasar will not arm if your battery is below 50%, or about 7.50V. 3.7V is the nominal rated output voltage, but the reality is that a fully-charged LiPo cell will read 4.2V or near. That's a lot of leeway, so if it's already drained down that far before you fly it may end up going dead (below 3.2V) if you have to spend a lot of time looking for your rocket. As always, the best policy is to charge your batteries completely before each flight, and/or use a fresh battery.

Note: DO NOT use a 9V alkaline battery with your Quasar. Most 9V alkaline batteries are only good for a few hundred mAH capacity, so you may get less than 60 minutes of use out of one. They also won't source enough current over an extended period of time to power a Quasar. We realize that they ARE easy to get and they ARE convenient because you don't have to mess with charging them, but having an expensive rocket lawn-dart into the ground because of a weak battery is not something we like to see.

About Deployment Loads…

The Quasar is designed to handle most typical deployment loads (ematches, small igniters) using a single 2S LiPo battery, which powers both the logic and the deployments. Unlike many other altimeters, the Quasar is designed to current-limit the outputs to 10A, and the drivers will shut off the output if the voltage drops below 4.5V, so it's essentially impossible to cause a "brown out" that shuts off the altimeter if a deployment draws too much current from the battery… the drivers will shut off the load before the altimeter loses power.

Even though the Quasar is brownout-protected, we recommend that you size your battery big enough so that it can handle a short on your igniter for a few seconds without severely lowering the voltage output of the battery. Our general rule is that the battery's output current capability should be at least 5 times the all-fire current of your igniter, 10x would be better. For example, a 7.4V 350 mAH 20C battery can put out 20x 350 mAH, or about 7,000 mA (7A). If the all-fire current on your ematch is 1A, that's a 7x safety margin… plenty enough. In general, we also recommend that you don't fire the igniter any longer than you have to … 1 or 2 seconds is way more than enough for an ematch. Save the longer settings for a hot-wire cutter or something like that.

A Note on Switches…

The Quasar is different than most other altimeters in that it switches both sides of the deployment outputs. Other altimeters have one lead of the igniters tied to a common battery lead (usually but not always "+"), and the igniter is fired by closing a switch on the other lead (usually but not always "-") completing the circuit. The Quasar incorporates a MOSFET switch on the deployment power as well as the typical on/off switching of the deployment drivers, so that the igniters are essentially "dead" until you are almost at apogee in flight. The only way you can fire an igniter on the ground is with the test web page, which you cannot get into from the normal Quasar web pages.. you have to enter a special URL to get to it. In addition, by default the Quasar does not self-arm… if you turn it on with ematches connected it will just sit there with the deployment power turned off until you arm it with your wireless device using the proper validation code. (You can optionally make it self-arm when power is turned on, if you select that option in the firmware… the default is that it has to be remotely armed).

What this means is that there is an electronic switch on the deployment power, interrupting the circuit and satisfying the NAR/TRA/NFPA requirement for a switch disconnect on the deployment power until it's armed. Because of this, you do not need to use a separate mechanical switch on the battery. You can connect your battery/batteries with confidence at your work table, knowing that there's no way to accidentally fire a deployment channel on the ground.

If you're using the AUX output channel for airstarts, you may still want to add a mechanical switch to that output. It's relatively easy to do that… all you need to do is to put it in series with your AUX output load. That way, you can arm the mechanical switch on AUX, then the remote arming.

Some Level 3 TAP's/L3CC's may require that you add a mechanical power switch to the Eggtimer Quasar, regardless of its protections. It's easy to do that by simply putting it in series with the battery. Note that if you do this, you will have to wait until you have a GPS lock before you launch… fortunately the Status Page tells you your GPS fix status, so it's easy to check before you arm your Quasar, and you typically get a GPS fix outdoors in less than one minute.

About Soldering Your Quasar…

Assembling your Quasar kit isn't terribly 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 Quasar uses a number of Surface Mount Technology (SMT) parts, they are large by SMT standards, and are within the realm of being hand-solderable. 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 on using flux: Be VERY careful about your choice of any extra flux. You really don't need to use any, but if you do choose to do so make sure that you use a liquid "no-clean" type of flux such as Kester 951. DO NOT use any kind of rosin or similar organic flux, it is almost certainly going to be incompatible with the flux in the no-clean solder and make a big mess. Extra flux may require excessive heat in order to boil off the flux, possibly damaging the sensitive components in the kit.

For soldering components on a board like the Quasar, 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 with a conical tip that's about the same width as the smallest pad. .032" (.8 mm) conical tip is ideal. We do NOT recommend that you use an extremely-fine "needle nose" tip, we have found that they may not conduct enough heat to the pads to allow the solder to flow out well. A conical tip with a 1/32" width (.031") should be fine.

General Assembly Information

We're sure that you are ready to 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, or a temperature-controlled soldering station, with a fine conical tip (0.8mm recommended)

___ Small needle-nose pliers

___ Small diagonal cutters

___ Tweezers to handle the SMT parts

___ A mesh "sponge" for cleaning your soldering iron tip

___ A tip cleaner block for keeping your iron nice and shiny

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

___ A PanaVise or similar board holder; if you don't have one, you can use four #4 screws and nuts, but it will be harder to work with.

___ 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 (if you drop a SMT part in carpet, you'll never find it…)

___ 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 Quasar, deviating from them isn't going to make your life any easier.

We strongly recommend that you consult the assembly pictures as you build your Quasar, 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 Quasar

Step 1: Sort the Components

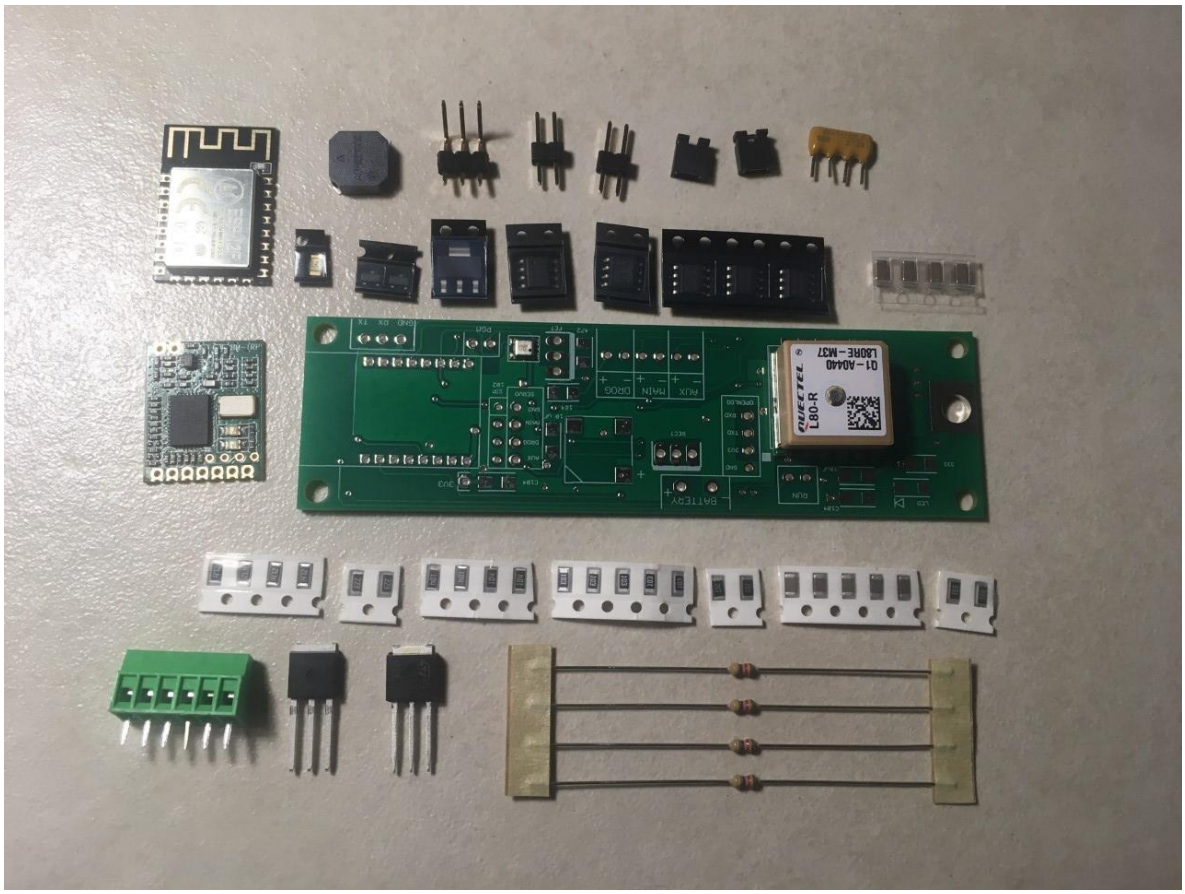
Before you start soldering anything, you need to lay everything out and make sure that you are familiar with all of components, and that you have everything. If you are missing something, let us know immediately so we can send you whatever you need. You should have the following parts, check them off as you sort them. Note that some of the smaller parts may have extras… you don't want to have to stop just because you drop some teeny little part. Also note that there may be one or two parts that you don't have depending on your board revision; check the revision on the board before you decide that you're missing something.

___	1	PC Board with pre-mounted GPS module and pressure sensor
___	1	Hope RF HM-TRP RF Module (band-specific)
___	1	ESP8266-12F WiFi Processor (pre-programmed for specific band support)
___	1	CAT24C512WI-GT3 Serial EEPROM (8-pin SOIC, marked "24C512")
___	1	PCA9536 I/O Expander (8-pin SOIC, marked "PCA9536")
___	1	NCP1117-33 3.3V voltage regulator (SOT-223 package)
___	3	VN5E160S Driver (8-pin SOIC, marked "VN5E160S")
___	1	Power FET (3-leads, marked "FQU 13")
___	1	FERD20S100 Rectifier (3-leads, marked "FD20)"
___	1	SI2302 FET (3-leads, SOT-23, very tiny… be careful when you handle it!)
___	1	1206 Amber LED (may be clear)
___	1	AD-85D3CR Buzzer, square with a "notched" corner
___	4	.1 uF 1206 SMT capacitor (brown part in paper tape)
___	3	10 uf 1206 SMT MLCC capacitor (brown part in clear tape)
___	1	330 ohm 1206 SMT resistor (marked 331)
___	1	1K 1206 SMT resistor (marked 102)
___	3	4.7K 1206 SMT resistor (marked 472)
___	4	10K 1206 SMT resistor (marked 103)
___	1	22K 1206 SMT resistor (marked 223)
___	3	100K 1206 SMT resistor (marked 104)
___	4	1/8W leaded resistors (value not important… we're just using them for the leads)
___	1	3x1K resistor SIP (4-pin inline package)
___	2	2-pin headers
___	1	3-pin right-angle tall header
___	2	Shorting jumpers (one is a spare)
___	1	6-pin x 2.54mm screw terminal block

Loose

___	1	Screw-mount antenna (band-specific)
___	1	.020" 63/37 no-clean solder

Note: You may have more than the listed quantity of some parts… we provide spares for some of the easier to lose parts. If you drop a SI2302 FET on the floor, the chances of you finding it are not good… 😊



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 Quasar 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 Quasar, 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 Quasar 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 making a noise (buzzer) to nothing at all working. 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 Quasar 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.

It is very important that you assemble the Quasar 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. 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.

Since there are parts on both sides of the board, you’ll need to be able to hold the board down and be able to flip it over. We recommend against simply setting it down on your work table… if you push hard enough on the components you can break things. A small hobby vice with a swivel (such as a PanaVise) would be ideal, but if you don’t have one you can simply use short #4 screws and nuts to elevate the board off the table; this is what we show in the build pictures.

If you have any questions about the assembly, please send us an email, to support@eggtimerrocketry.com , BEFORE you start building. We generally answer all questions the same day, and we do our best to ensure your success.

Eggtimer Quasar Assembly Checklist

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 Quasar 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.

About soldering the resistors and capacitors

A lot of people get put off by the idea of having to solder small SMT parts like resistors and capacitors, but it's really not that hard to do once you get the hang of it. In fact, many of our users prefer SMT parts to through-hole parts, because you don't have to clip the leads and they just plain look cooler. Here's how to mount them… once you do one or two you'll find that it's actually pretty easy.

Lightly tin only ONE of the two pads on the board. With tweezers, lay the part down on the board, and heat up the lead over the tinned pad until the solder flows. Wait a few more seconds, then remove the heat, holding the part there until the solder cools for a few seconds. Let it cool for another 10 seconds, then carefully solder the other pad, being careful not to use too much heat. Once the solder starts to flow, remove the heat and let the joint cool. If you keep the heat on too long, you may heat up the part enough so that both joints melt and the part is likely to lift off the board when you remove your iron. It might also "tombstone", that is, lay on end due to the previously-soldered joint melting. If this happens, just heat up the joint, remove the part with your tweezers, and try again.

After you've soldered the part in place, inspect the joint carefully with a 10x jeweler's loupe. You should see good solder coverage on the pad with the solder wicking up to side/end of the part, and there should not be any solder splatter or bridges. (Splatter means your iron is too hot… turn it down about 20F and try again). If you don't like what you see, heat up the joints and remove the part, and/or clean it up with some solder wick, and start over.

About Soldering the SOIC-Package IC's…

There are several 8-pin IC's in a "SOIC" (Small Outline IC) package, they have leads that are bent out into a "J" shape. In order to solder these to the board correctly, you MUST have the right soldering tip (0.8mm conical is recommended), and your iron MUST be clean and at the right temperature. If you have a 12W/15W pencil iron, it's probably OK as-is. If you have a temperature-controlled soldering station, we recommend that you start at 680F, and go up or down by about 20F depending on whether the solder sticks and doesn't want to flow (turn it up) or appears to "pop" when you apply the solder (turn it down).

The trick to soldering the SOIC packages is that you need to have the solder get underneath the J-leads, so that it connects the "elbow" on the lead with the PC board pad underneath. To do

that, we recommend that you apply the iron to one side of the lead, wait 3-5 seconds for it to heat up, then apply the solder to the other side of the lead. If the temperature is correct, you'll see the solder flow and make a nice junction between the lead and the board. If you don't get it right, remove the excess solder with some narrow desoldering wick, and try again. You don't need to use a ton of solder… if your solder joints have a little "peak" sticking out the end when you remove the soldering iron then you're using too much solder.

Locating Pin 1 on the 8-Pin SOIC IC's

It's crucial that the 8-pin IC's are mounted properly, if you have them upside down then your Quasar is not going to work properly, if at all. All IC's with two rows of pins have some kind of marking on Pin 1, which is the index pin that the other pins are numbered from, and which helps your orient the chip properly. The Quasar PC board has markings on the board that line up with Pin 1, however in some cases it can be challenging to figure out where it is on the chip.

To find Pin 1, look for:

- A mark or indentation on one of the corner pins
- A notch at one end of the chip; Pin 1 will be the lower-left pin
- A bevel on one row of the chip; Pin 1 will be the lower-left pin
- Look a the writing on the chip; if it's upside-up, then Pin 1 is the lower-left pin

Look at the pictures before you place the chips to verify your alignment. If in doubt, send us an email at support@EggtimerRocketry.com BEFORE you mount the chip.

Alternate Method: Using a Hot Air Tool…

If you've done a fair amount of SMT work you may have a hot air rework tool. These are very cool, and they can make SMT soldering a lot easier if you have some experience. You can speed up the assembly a bit if you have some no-clean solder paste and a hot air tool. Just put a very small amount on the pads for each part (it shouldn't be blobbed up… you only need a tiny bit), set the part on the pads, then gently go over the pads with your hot air tool. We recommend about 300C to start with, adjust the temperature up or down depending on your specific paste. Note that we strongly recommend that if you do it this way you use solder paste containing no-clean flux, most of them are that way nowadays, though. We recommend that you do one part at a time, that helps prevent you from accidentally knocking some part off the pads and smearing the solder paste somewhere that you don't want it to be. Note that only about half of the parts are SMT, so you're still going to have to use a soldering iron and the wire for the through-hole parts, and that includes the WiFi module.

DO NOT use a hot air tool to mount the WiFi module. First, there are some vias that could potentially make contact with the WiFi module pads, so you don't want the module to be laying flat against the board. Second, if you get it a little too hot you can damage the WiFi module, and/or loosen the metal RF shield (which is there for FCC compliance), possibly shorting the pads. Just mount it as directed as a through-hole part using the cut-off resistor leads and you'll be fine.

OK, so let's get started…

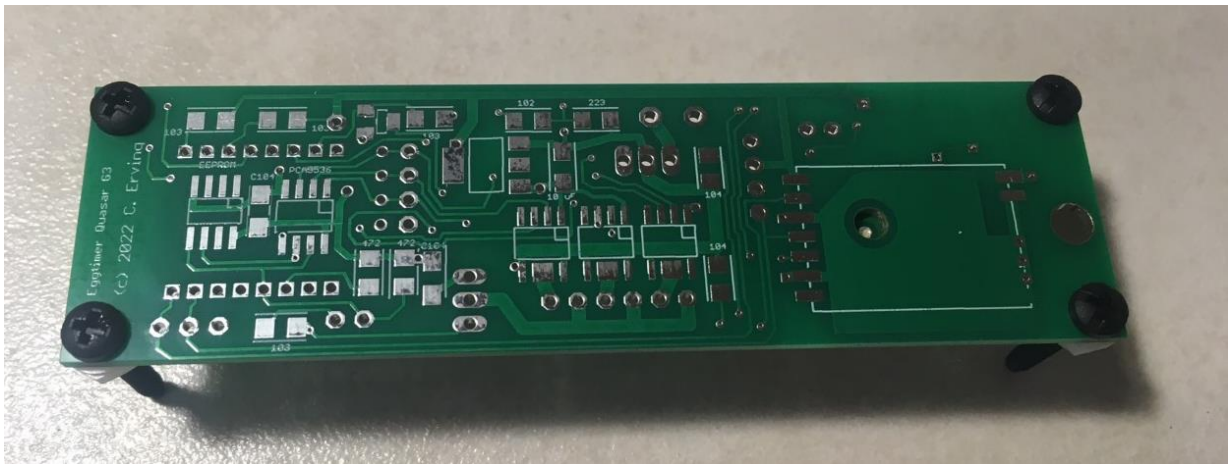
Mounting the Bottom-Mount SMT Parts

There are parts mounted on both sides of the Quasar board, this is done to save space. It does make the assembly task a little bit more complicated, but in general most of the smaller parts are mounted on the "bottom" side of the board (i.e. the side that you don't see when it's mounted in your AV bay). We'll start with the bottom side, then go to the top side afterwards.

__ Orient the board

Mount the board in your hobby vise so that the GPS module is facing down.

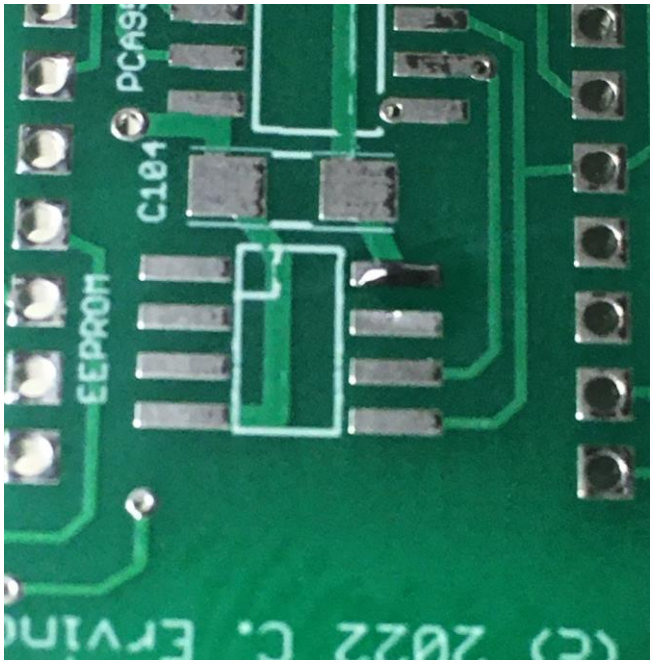
If you do not have a hobby vise, we recommend that you use some #4 x ¾" screws with a ¼" spacer to lift the board off the table… you do NOT want to push down directly on the board, since it may cause damage to the GPS module.



__ Mount the CAT24C512 EEPROM (8-pin SOIC chip marked "24512")

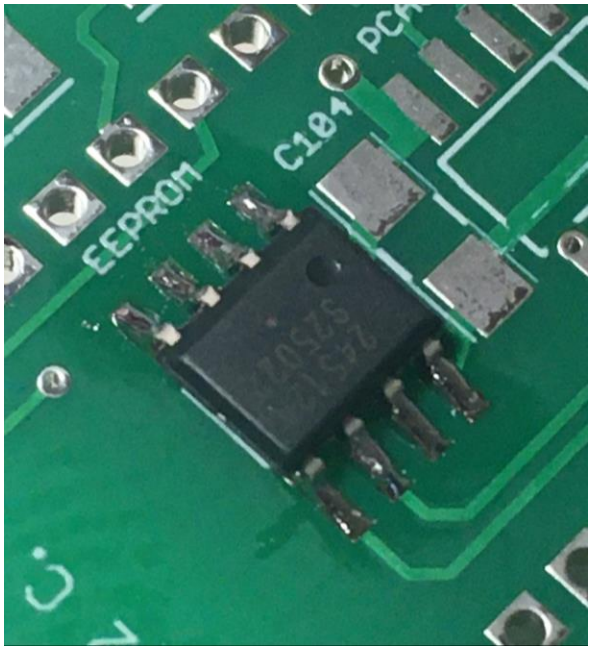
Locate the spot for the EEPROM, it's the 8-pin chip on the left side of the board. Remove the EEPROM from its package, it's marked "24512"… there are other parts that look very similar, so make sure that you have the right one! You'll see that there is an indentation dot at one corner of the chip, this corresponds to the little square that's marked at the top-left pad.

Tin the upper-right pad with just a little bit of solder.



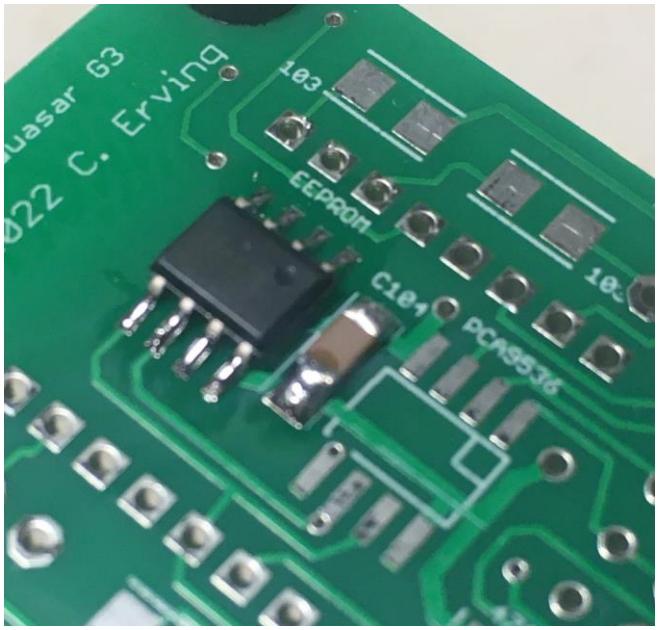
With tweezers, hold the EEPROM in place, and heat the lead over the tinned pad until the solder melts. Keep the heat on for another 3-4 seconds, then remove the iron and let the pad cool. Note that the writing on the chip will appear to be upside-down in relation to the writing on the PC board.

Check the alignment of the EEPROM on the pads, all of the leads should be centered on the pads. If not, heat up the lead and carefully move the EEPROM in place. After you are satisfied with the alignment, solder the remaining leads, and touch up the first one that you soldered if you're not satisfied with the joint. It doesn't take much solder… just enough to get a good connection between the leads and the PC board pads.



__ Mount the .1 uf Capacitor (brown part in paper tape)

Locate the spot for the .1 uF capacitor right next to the EEPROM, it will be marked “C104” on the board. Solder in place.

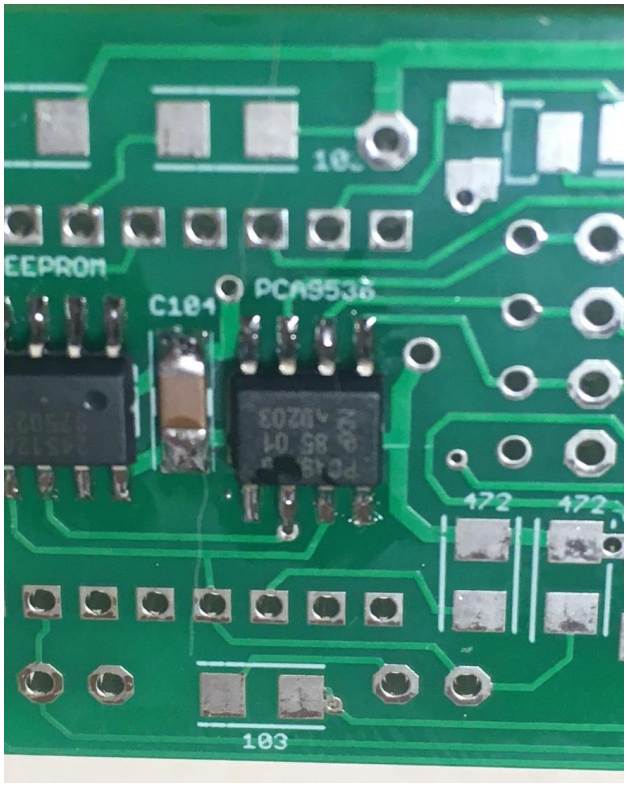


__ Mount the PCA9536 I/O Expander (8-pin SOIC chip marked PCA9536)

Locate the spot for the PCA9536, it’s next to the .1 uF capacitor that you just mounted. Remove the PCA9536 from its package, it’s marked “PCA9536”; make sure you have the right one, there are others that look very similar! Pin 1 on the PCA9536 isn’t marked, so you’ll need to make sure that the writing is upside-up, on the side of the PC board with the Pin 1 marking square; it’s going to be the same as the 24C512 EEPROM that you mounted earlier.

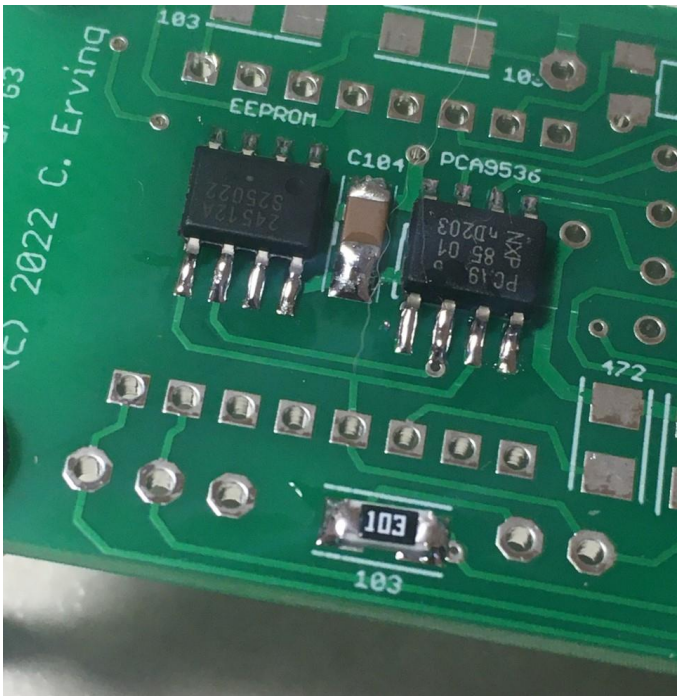
Tin the upper-right pad with just a little bit of solder. With tweezers, hold the PCA9536 in place, and heat the lead over the tinned pad until the solder melts. Keep the heat on for another 3-4 seconds, then remove the iron and let the pad cool. Note that the writing on the chip will appear to be upside-down in relation to the writing on the PC board.

Check the alignment of the PCA9536 on the pads, all of the leads should be centered on the pads. If not, heat up the lead and carefully move the PCA9536 in place. When you’re satisfied with the alignment, solder the remaining pads.



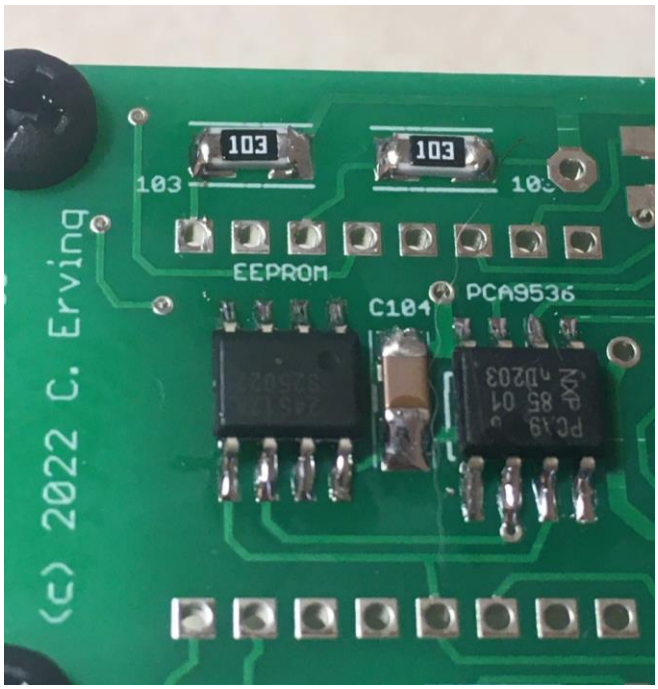
__ Mount the 10K resistor (marked “103”)

Locate the spot for the 10K resistor located near the bottom edge of the board below the EEPROM and PCA9536 chips, it will be marked “103” on the board. Solder in place.



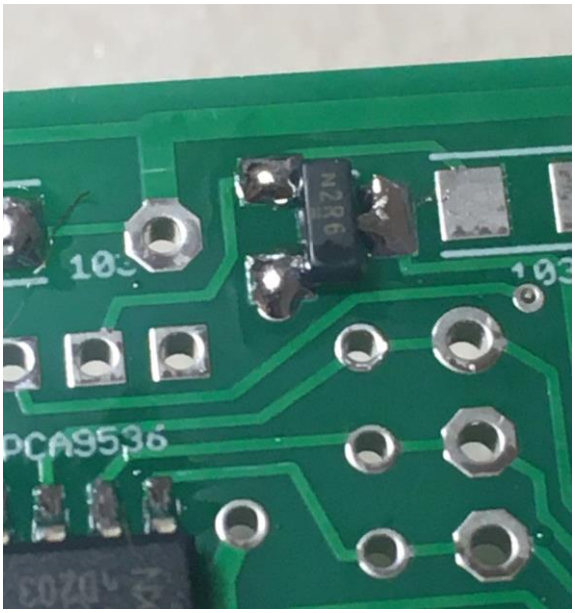
__ Mount the two 10K resistors (marked “103”)

Locate the spot for two 10K resistors near the top-left edge of the board, they will be marked “103” on the board. Solder in place.



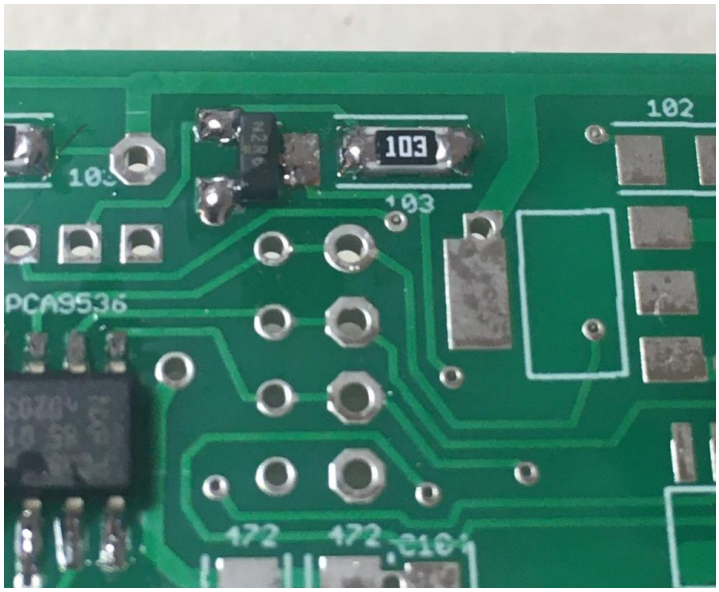
__ Mount the SI2302 FET

Locate the spot for the FET on the PC board, it’s a small box with 3 leads: two on one side, and one opposite, just to the right of the 0.1uF capacitor that you just soldered. .Lightly tin the single pad. Carefully remove the SI2302 FET from its package… yes, it’s very small. With tweezers, hold the FET to the pads as you heat up the tinned pad, then remove the iron. Let it cool for 5 seconds. Make sure that the two leads on the left are on the pads… they should be sitting near the edge of the pads, which have been made oversized to make it easier to solder them. Solder the other two pads, then go back and resolder the single pad if the coverage looks a little thin.



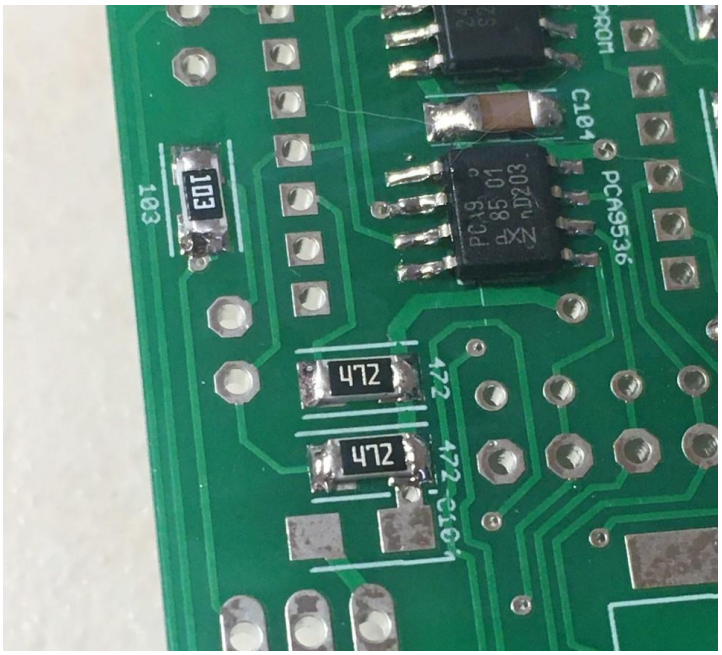
__ Mount the 10K resistor (marked “103”)

Locate the spot for the 10K resistor to the right of the SI2302 FET, it will be marked “103” on the board. Solder in place.



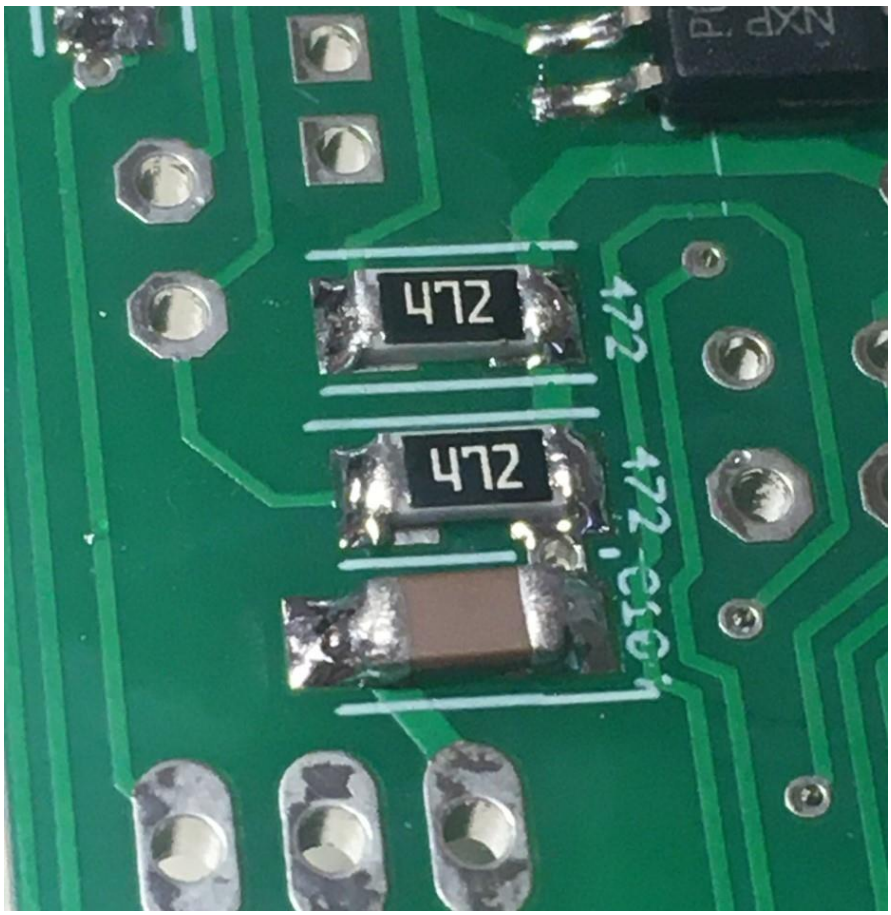
__ Mount the two 4.7K resistors (marked “472”)

Locate the spot for two 4.7K resistors just to the lower-right side of the PCA9536 chip, they will be marked “472”. Solder in place, making sure that they are properly centered so they do not short against one another.



__ Mount the .1uF capacitors (unmarked brown part in PAPER carrier)

Locate the spot for the .1 uF capacitor next to the two 4.7K resistors that you just soldered, it will be marked “C104”. Solder in place.



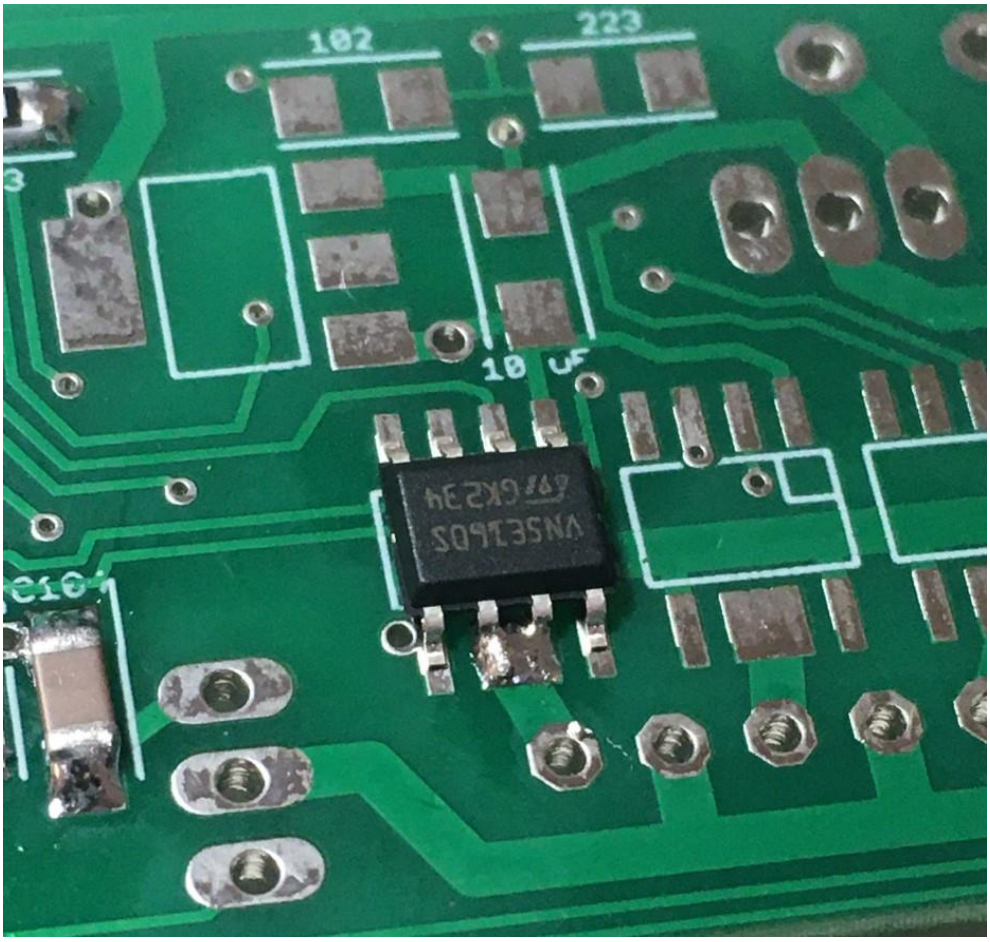
__ Mount the left VN5E160S driver

Locate the spots for the three driver chips, they are 8-pin chips near the bottom-center of the board. You will notice that the upper-right corner has a square marked out, that's the Pin 1 mark. You will also notice that the lower-center two pads are connected and have a large pad between them; those are the output pads.

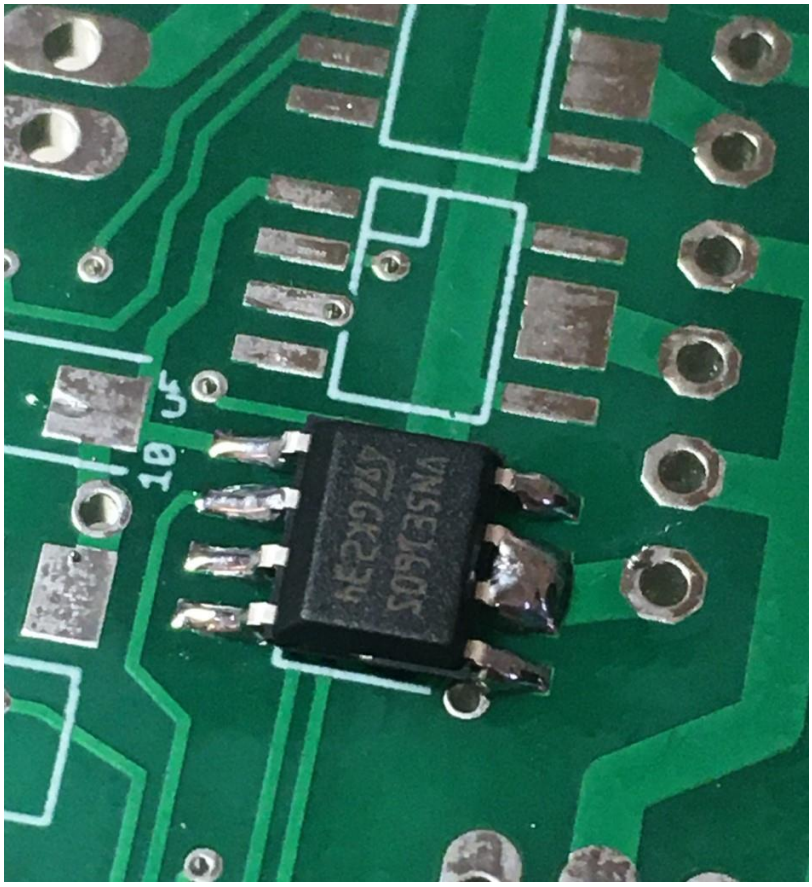
Remove one VN5E160S driver chip from the tape. You will see that one side is "square" and the other side has a bevel cut in the side. The side with the bevel is the Pin 1 side; this side MUST line up with the Pin 1 square mark on the PC board. You can also tell the Pin 1 side by looking at the writing on the chip; it will be rightside-up on the Pin 1 side, but appear upside-down in relation to the markings on the PC board.

Lightly tin the large pad on the bottom-center of the left driver's pads.

With a pair of tweezers, hold the driver in place while heating up the tinned pads, then gently slide the driver chip in place. Remove the iron. Make sure that all 8 leads are centered on the pads, if they are not then heat up the large pad again and re-orient the driver chip. It is CRITICAL that these chips are square on the pads; they carry a large amount of current, and if you get them off-center you may end up with a short that can damage your Quasar.

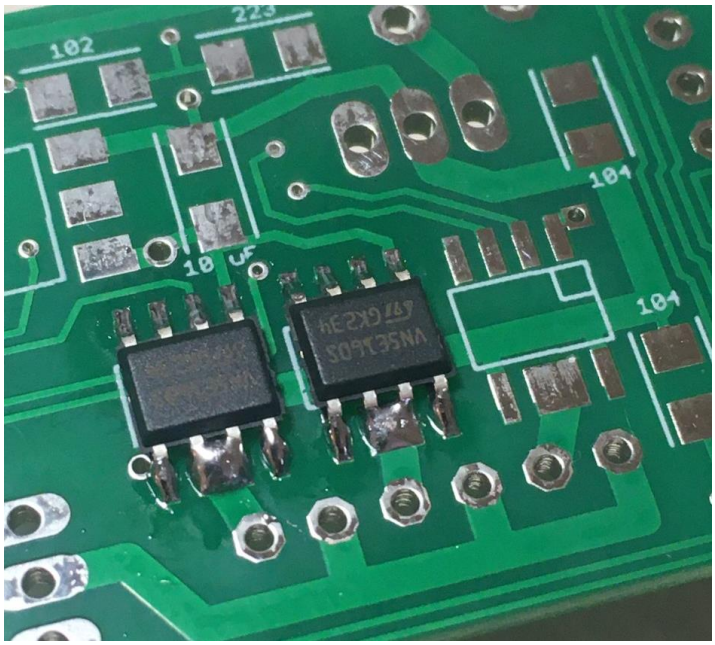


Once you're satisfied with the alignment of the driver chip, solder the remaining leads using the procedure that we detailed earlier. Make sure that you get a good solder joint between the leads and the PC board… it does not take much solder, so do not oversolder them!



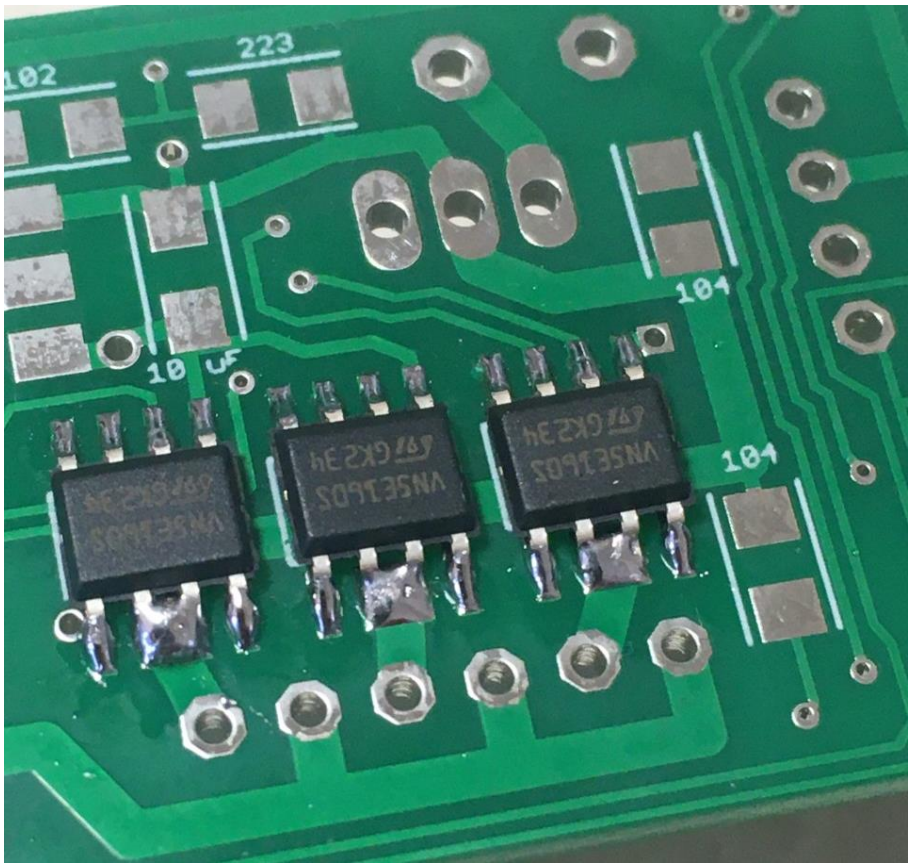
__ Mount the CENTER VN5E160S driver

Locate the second VN5E160S driver chip, just to the right of the one that you just mounted. Using the same procedure, solder it into place. Note that the writing on the chip will appear to be upside-down in relation to the writing on the PC board.



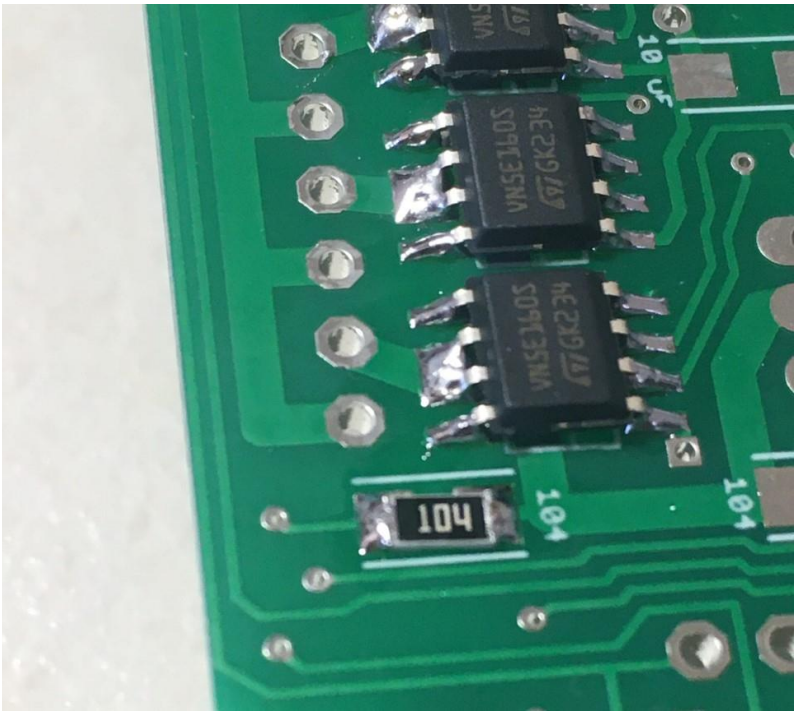
__ Mount the RIGHT VN5E160S driver

Locate the third VN5E160S driver chip, just to the right of the one that you just mounted. Using the same procedure, solder it into place. Note that the writing on the chip will appear to be upside-down in relation to the writing on the PC board.



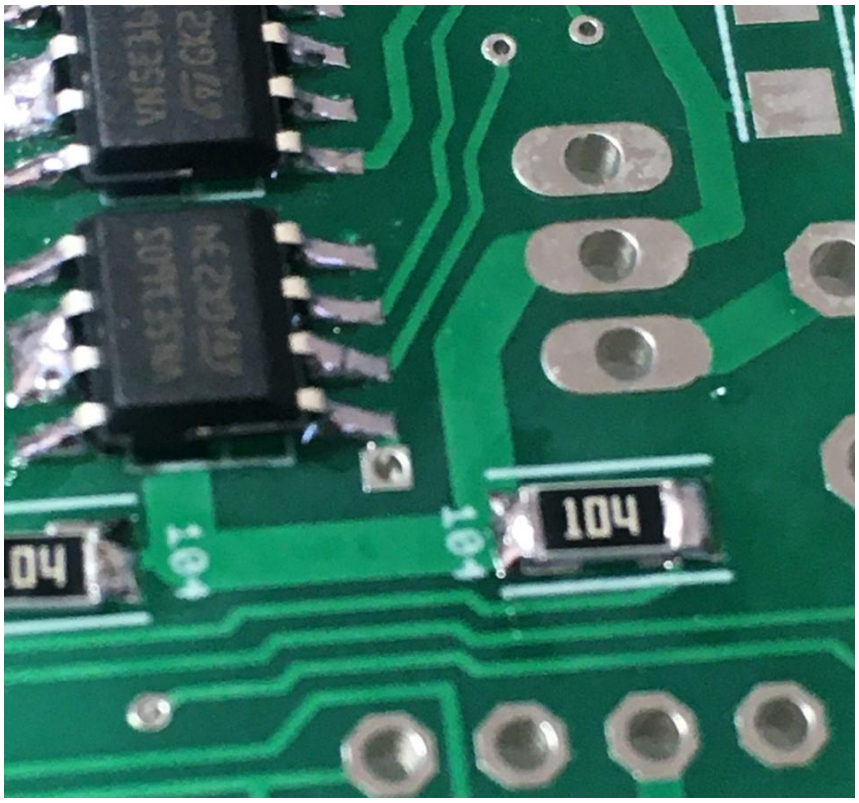
__ Mount the 100K resistor (marked “104”)

Locate the spot for the 100K resistor, it’s located just to the right of the driver chip that you just mounted, and is marked “104”. Solder in place.



__ Mount the 100K resistor (marked “104”)

Locate the spot for the 100K resistor, it’s located next to the 104 resistor that you just mounted, on the upper-right side of the drivers, and is marked “104”. Solder in place.

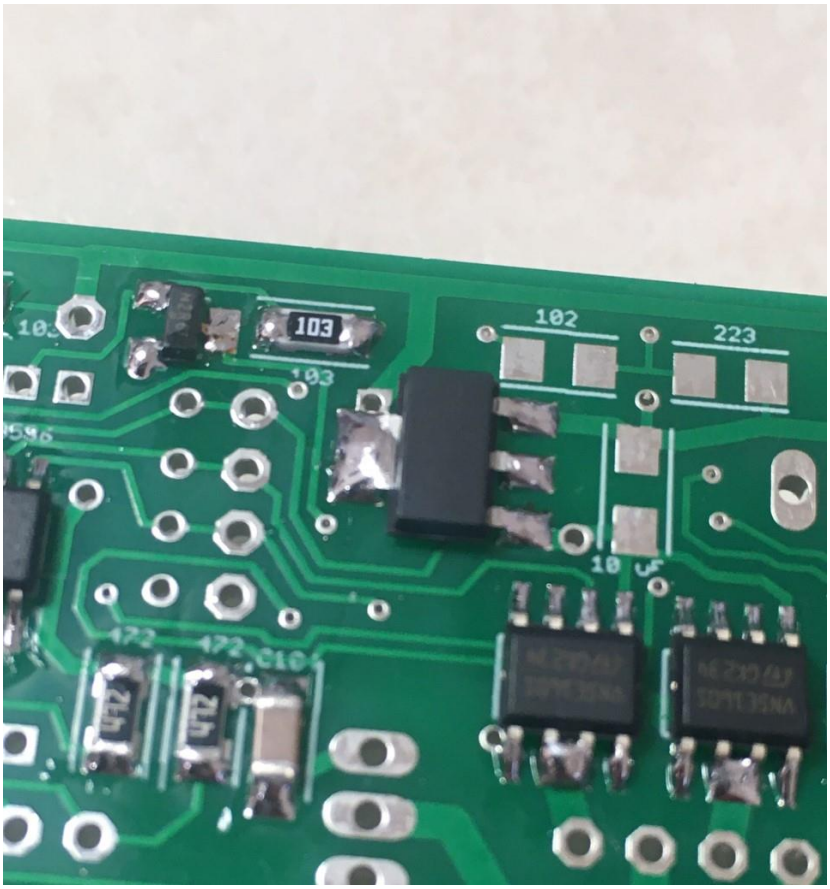


__ Mount the 3.3V Voltage Regulator

Locate the large pad and the three small pads for the voltage regulator, above and to the left of the two driver chips. Lightly tin the large pad on the PC board, just enough to cover it. Place the voltage regulator IC in place, and hold it down, then heat up the large tab 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 10 seconds. This should hold the regulator in place.

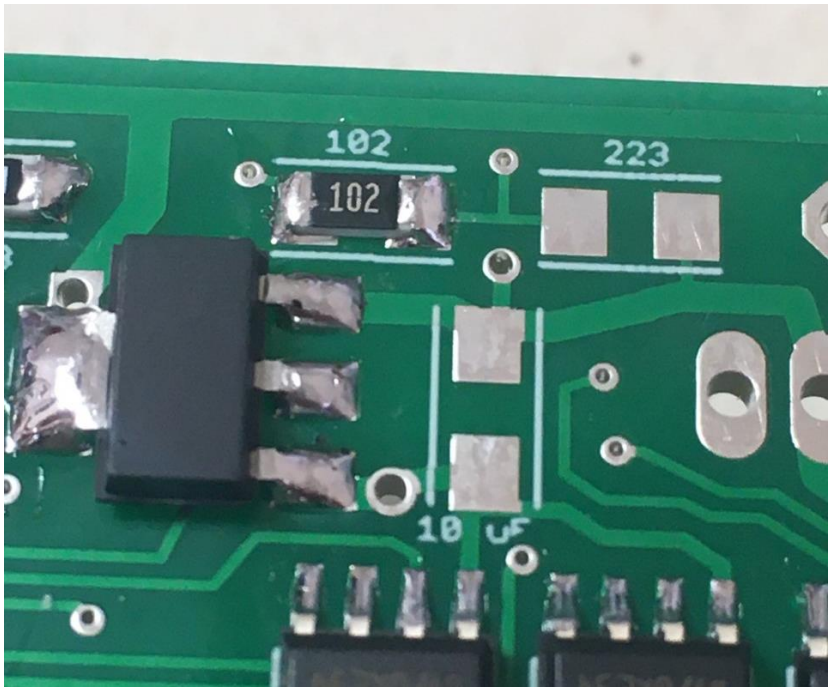
One by one, solder the three small three small leads to the pads, using enough solder to cover the pad and get a good "tenting" on the leads without creating solder "blobs". Wait at least 30 seconds between each pad to prevent the chip from overheating.

Now go back and heat up the tab again and flow more solder on the large pad, covering it and the tab with solder. You don't want a great big blob of solder, but you do want enough so that the tab is covered. This ensures that the pad underneath is well bonded to the tab, and the solder/tab acts as a heat sink for the regulator.



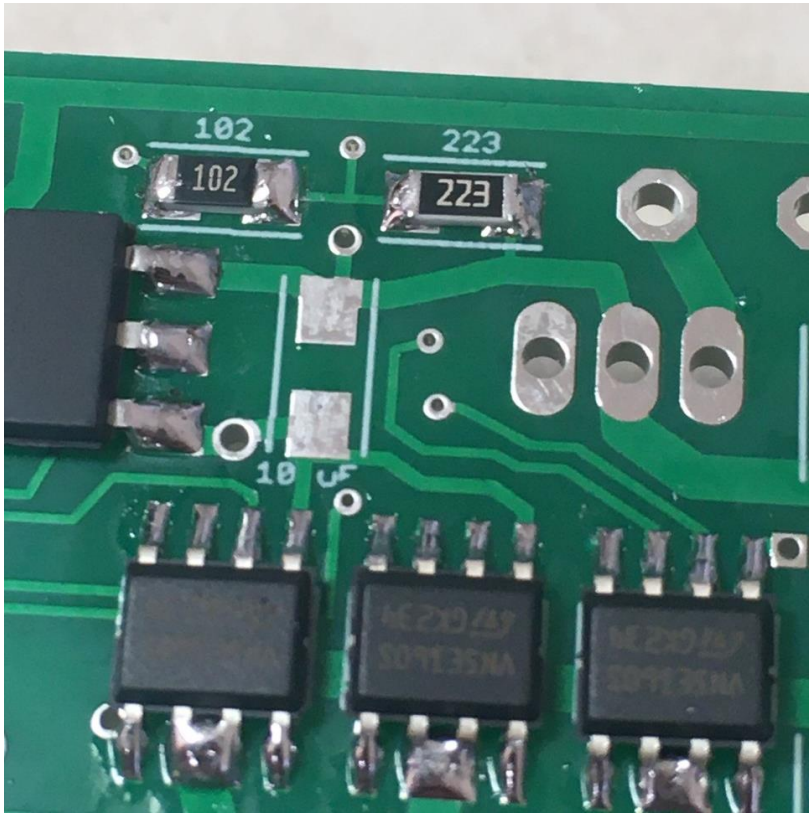
__ Mount the 1K resistor (marked "102")

Locate the space for the 1K resistor just above the regulator, it's marked "102". Solder in place.



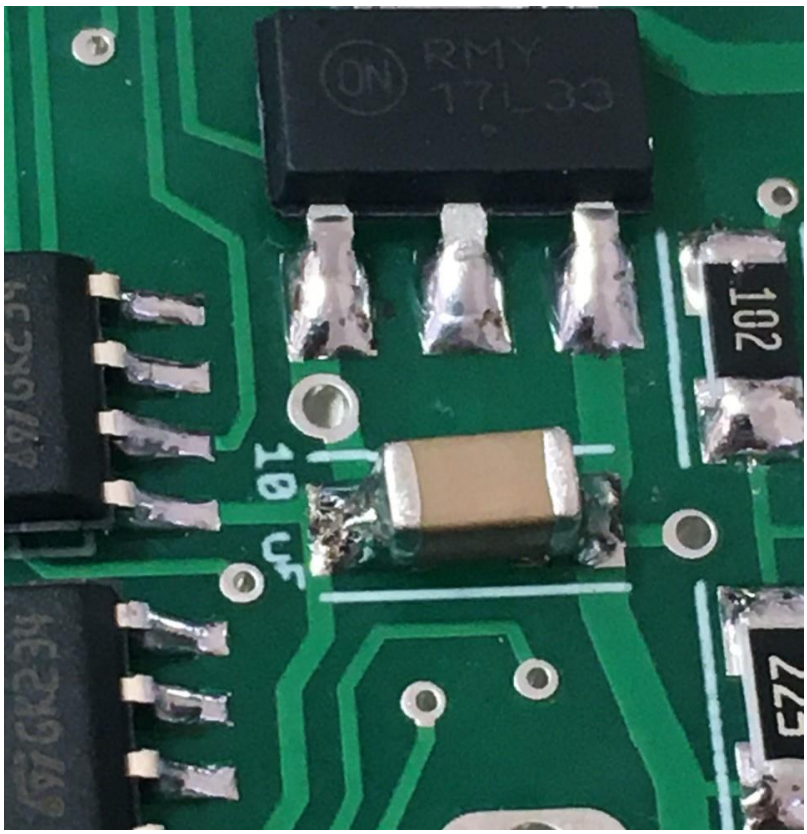
__ Mount the 22K resistor (marked “223)

Locate the space for the 22K resistor just to the right of the 1K resistor, it’s marked “223”. Solder in place.



__ Mount the 10 uF capacitor (unmarked brown part in CLEAR carrier)

Locate the spot for the 10 uF capacitor next to the voltage regulator, it will be marked “10 uF” on the board. Solder in place.



You are now done mounting parts on the bottom of the board… except for the RF Module.

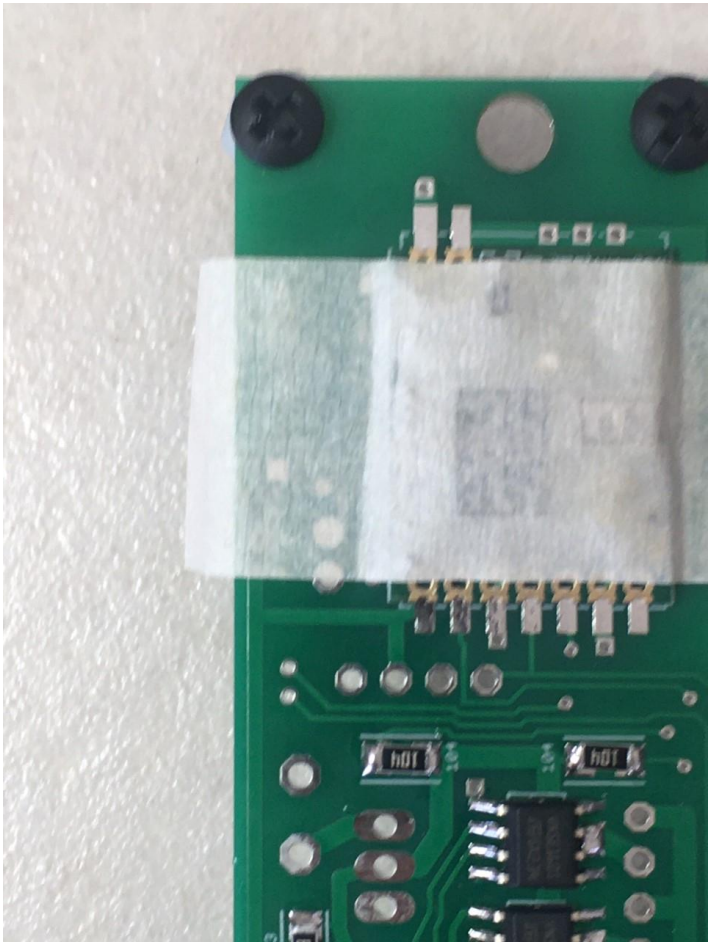
Mounting the Hope RF Radio Module

You will be surface-mounting the Hope RF radio module to the board, the pads are relatively large and spaced relatively far apart, however you need to be careful not to oversolder the pads because you can create solder bridges between the pads. You also need to mask off the top of the module to prevent any stray solder from getting onto the teeny tiny components on it. If you mount the RF module crooked, you may end up with a short underneath the pads, which will almost certainly fry the RF module and will be difficult to find… so be very careful when positioning it.

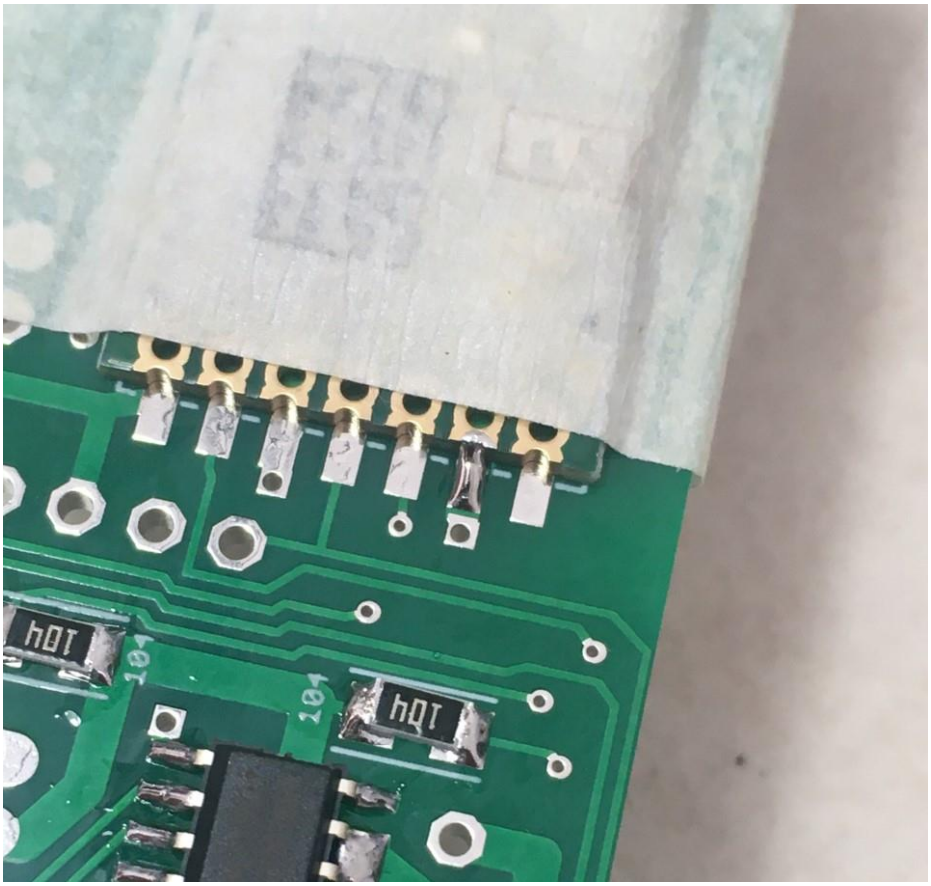
__ Cut a piece of masking tape about 2" long and about 3/4" wide.

__ Carefully position the Hope RF module on the board so that its pads line up with the pads on the PC board. With the masking tape that you just cut, lay it across the top to hold it in place on the board. Make sure that it's properly positioned, the outline of the module should match up with the outline on the board.

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. 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

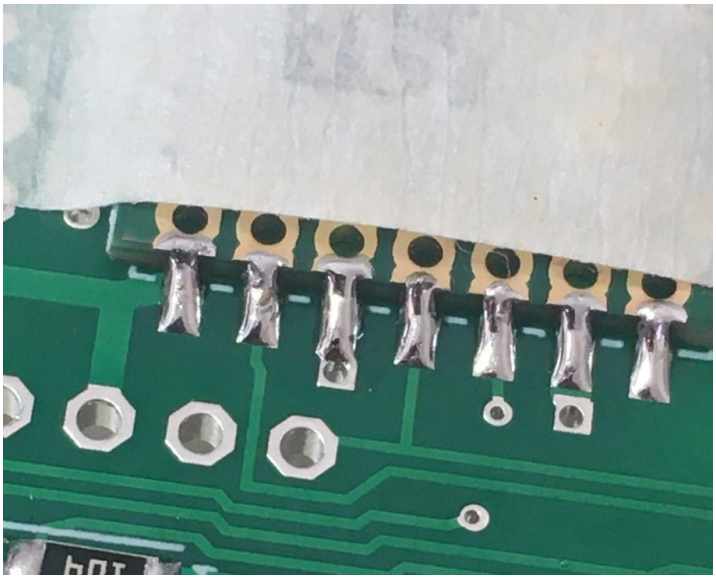


__ Solder the second pad from the bottom-right of the Hope RF module to the board. Make sure that the board is properly positioned after you solder this joint; if it moves, heat up the solder joint and move the board slightly so that it is properly positioned. Wait 30 seconds after soldering before continuing.

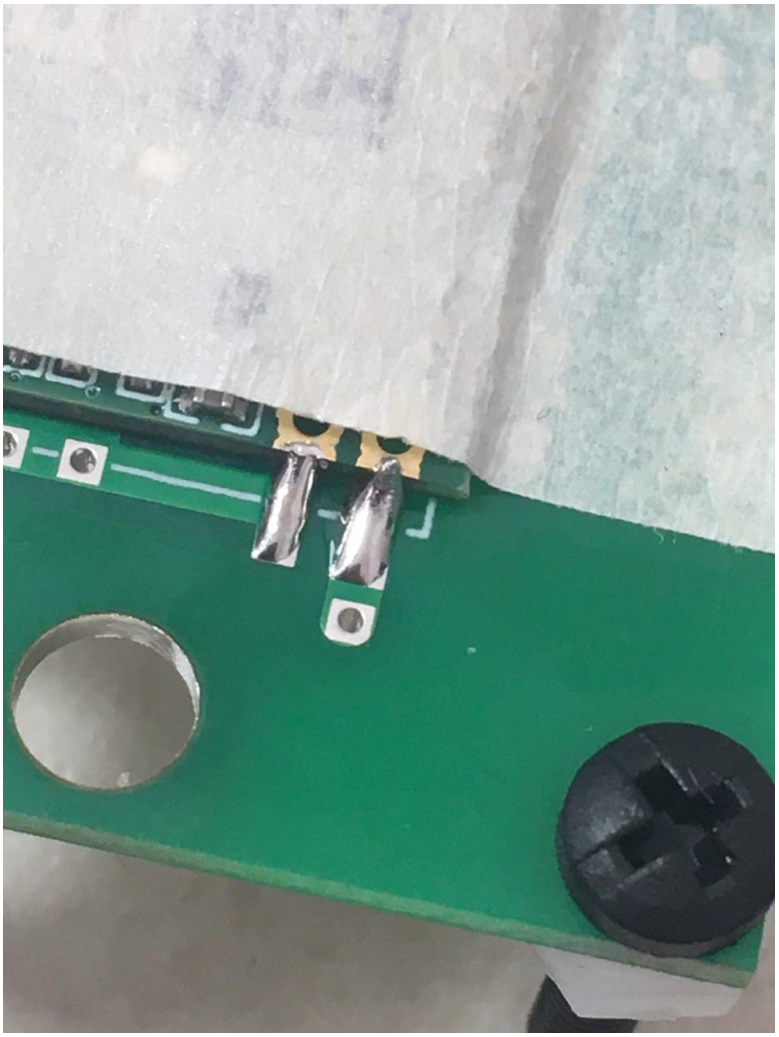


__ Check the alignment of the RF module to make sure that the two pads on the other side are centered on the pads. If necessary, heat up the pad that you previously soldered to re-align the module.

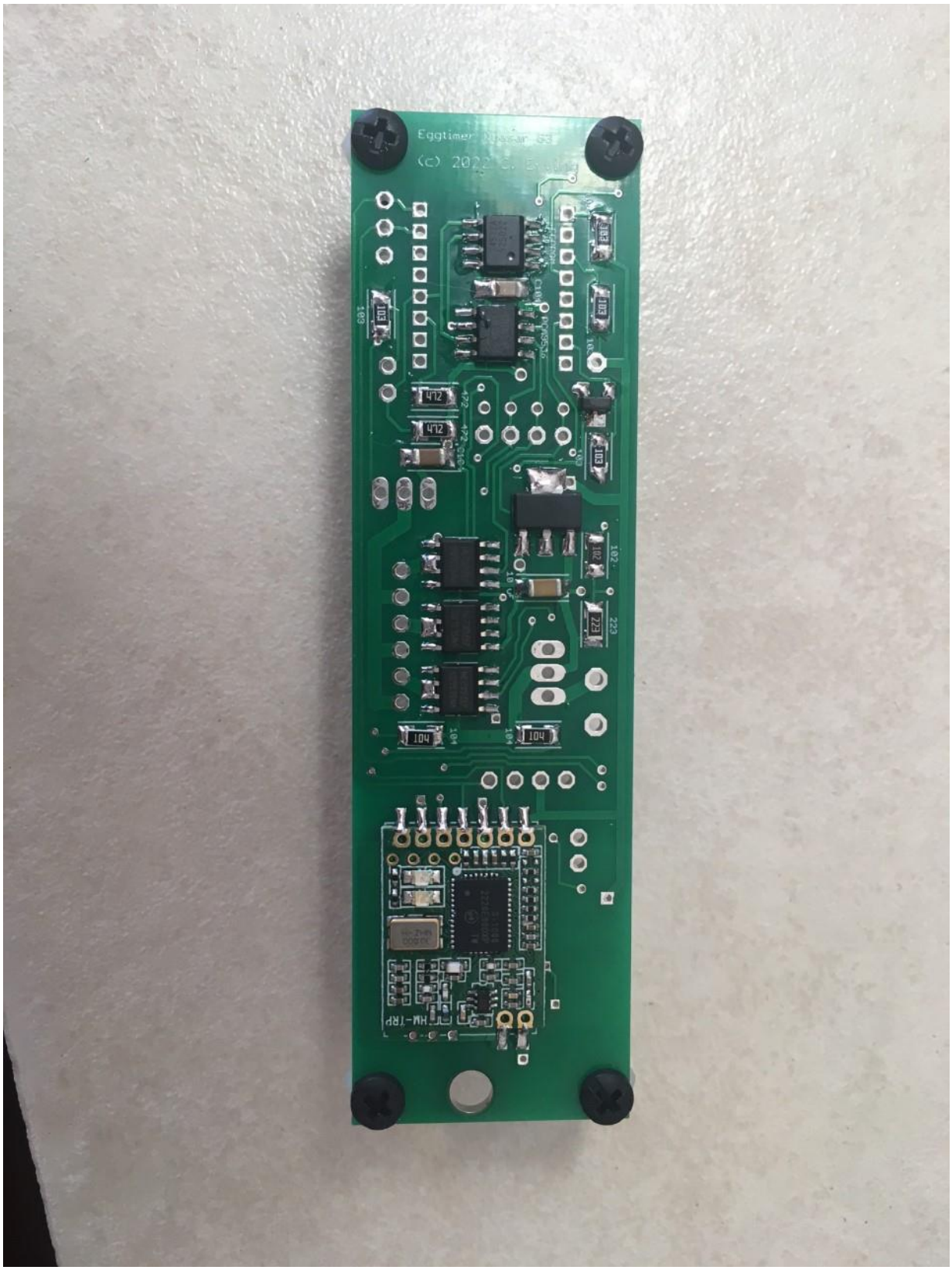
__ Solder the remaining six pads on the bottom side of the RF module to the board, waiting 30 seconds between pads to prevent the module from overheating,.



__ Turn the board around, and solder the two pads on the other side of the RF module.

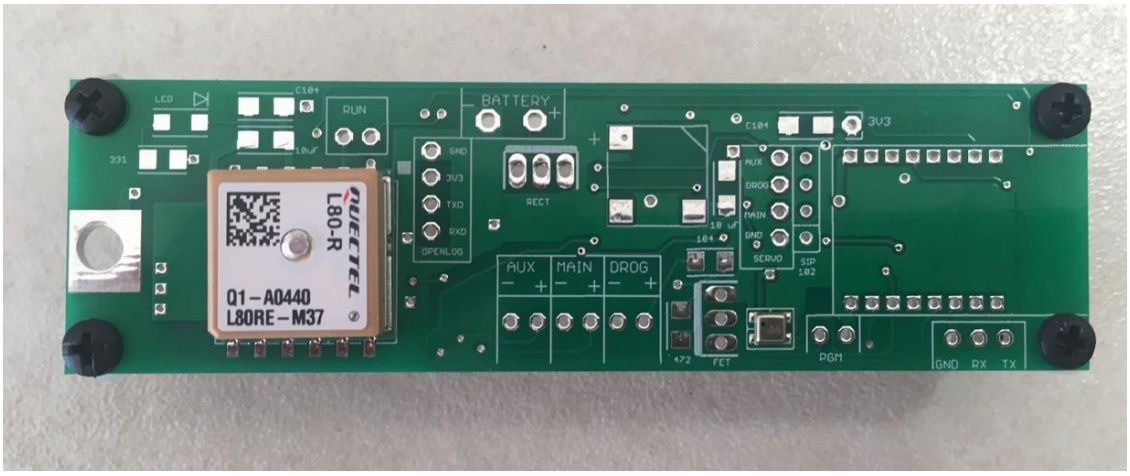


__ Inspect all the solder joints on the bottom of the board, using a 10x jeweler's loupe. They should all be nice and shiny, and the solder joints should clearly bridge the parts with the PC board pads. If you have any questionable joints, we recommend that you remove any excess solder with desoldering wick, and resolder.



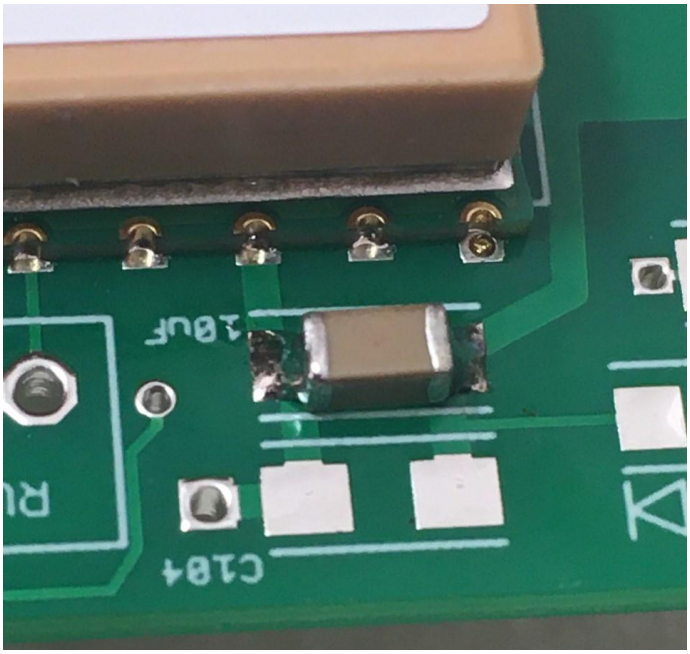
Mounting the Top-Mount Parts

Flip the board over in your hobby vise so that the side with the GPS module is now facing up. If you're using screws to lift the board off the worktable, reverse them so that the bottom of the board is raised from the table. You do NOT want to push down directly on the board, since it may cause damage to the leads of the surface-mounted IC's that you mounted on the bottom.



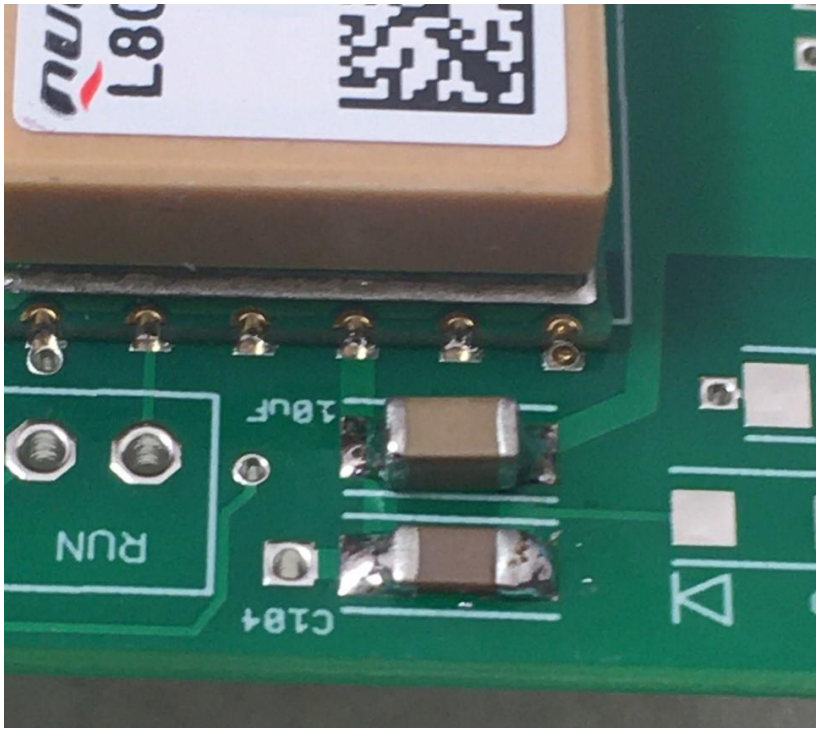
__ Mount the 10 uF capacitor (unmarked brown parts in CLEAR tape)

Locate the spot for the 10 uF capacitor, next to the GPS module, it's marked "10 uF" on the board. Solder into place.



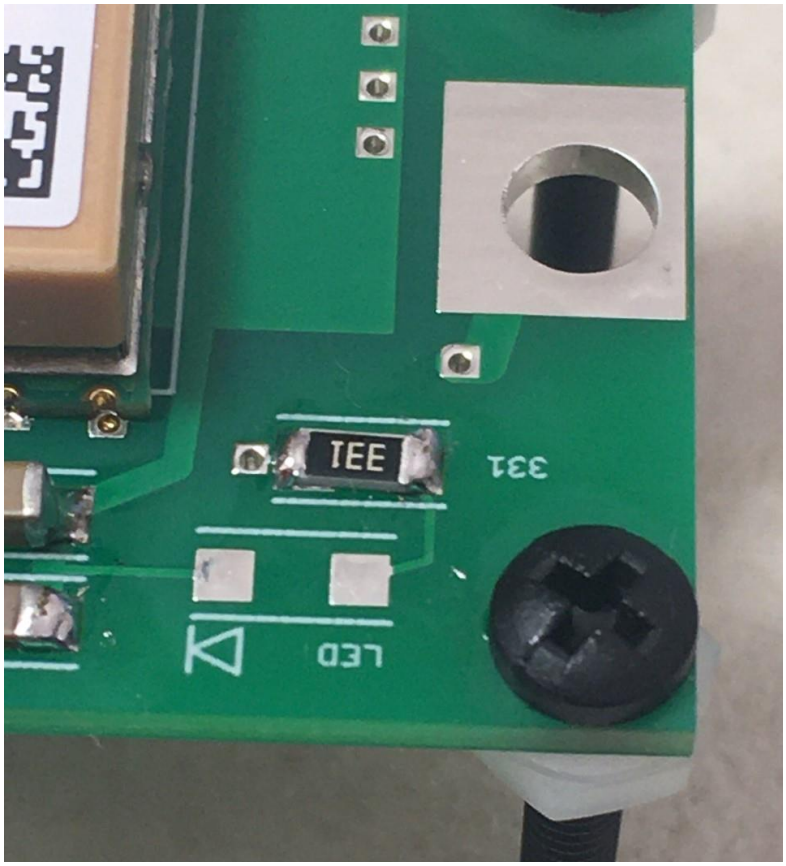
__ Mount the .1 uF capacitor (unmarked brown parts in PAPER tape)

Locate the spot for the .1 uF capacitor, next to the 10 uF capacitor that you just mounted, it's marked "C104" on the board. Solder into place.



__ Mount the 330 ohm resistor (marked “331”)

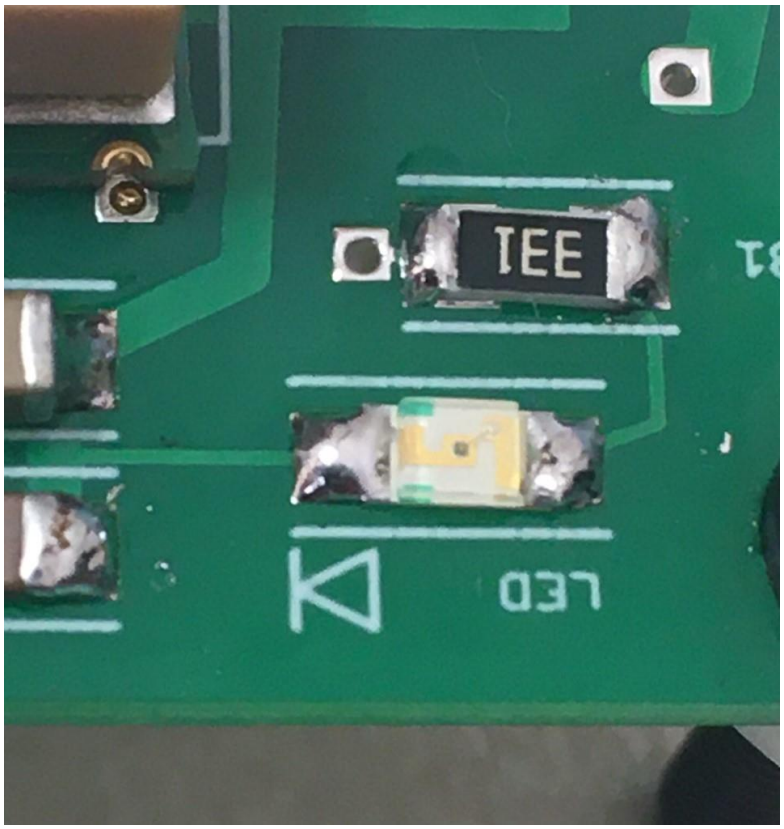
Locate the spot for the 330 ohm resistor on the top of the board, just below the LED, marked “331” on the board. Solder in place.



__ Mount the LED

Locate the spot for the LED, it's in the upper-left side marked with a diode symbol.

Carefully remove the LED from the package, you'll see a mark at the top of the LED with a green dot. The green dot needs to be on the cathode side, the side with the diode symbol. Solder in place.



___ Mount the buzzer

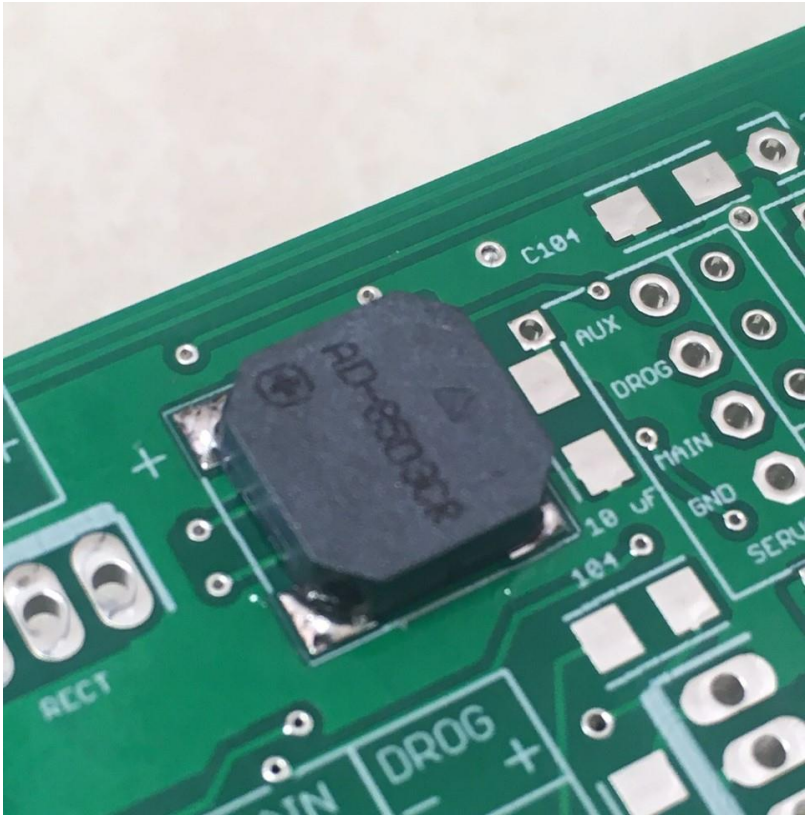
Locate the spot for the buzzer, it's a large square in the center of the board. You will notice that the upper-right corner has a diagonal mark on it, but that there is no pad to solder onto.

Remove the buzzer from the package, you'll see that one of the pads has a diagonal notch out of it. That pad must match the pad with the diagonal mark on the PC board. You'll also see that there's a "+" marking on the buzzer, that must match up with the "+" marking on the PC board.

Lightly tin the upper-left pad on the PC board, the one with the "+"marking. While holding your iron to the pad to keep the solder melted, place the buzzer on the pads, making sure that it's square and that the "+" marking on the buzzer is on that pad. It's VERY important that you have the buzzer square on the pads. If you're not satisfied with the placement, heat up the pad and fix the alignment.

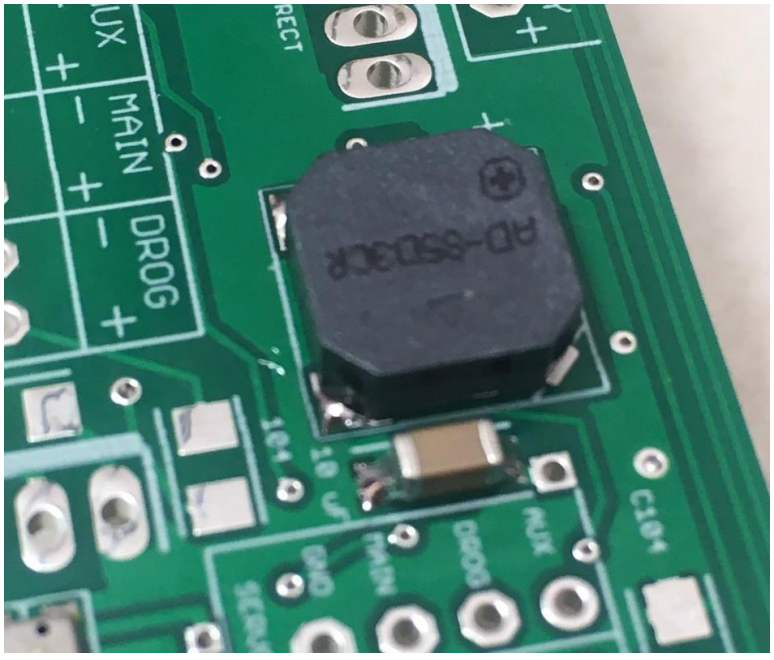
Once you're satisfied with the alignment of the buzzer, using as little solder as it takes to get a good connection, solder the lower-left and lower-right pads, and touch up the upper-left pad if

necessary. There is no pad on the upper-right corner (the one with the diagonal mark), so DO NOT solder it.



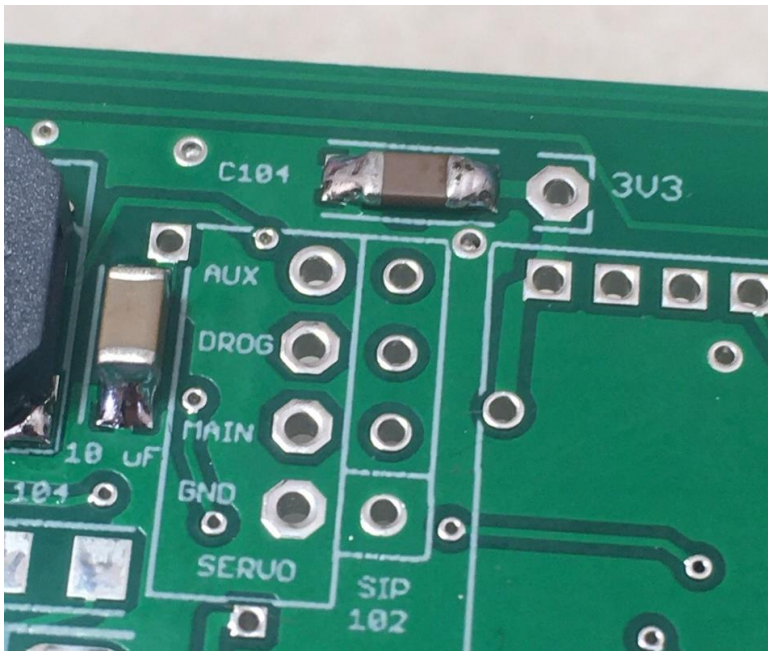
__ Mount the 10 uF capacitor (unmarked brown parts in CLEAR tape)

Locate the spot for the 10 uF capacitor just to the right of the buzzer, it's marked "10 uF" on the board. Solder into place.



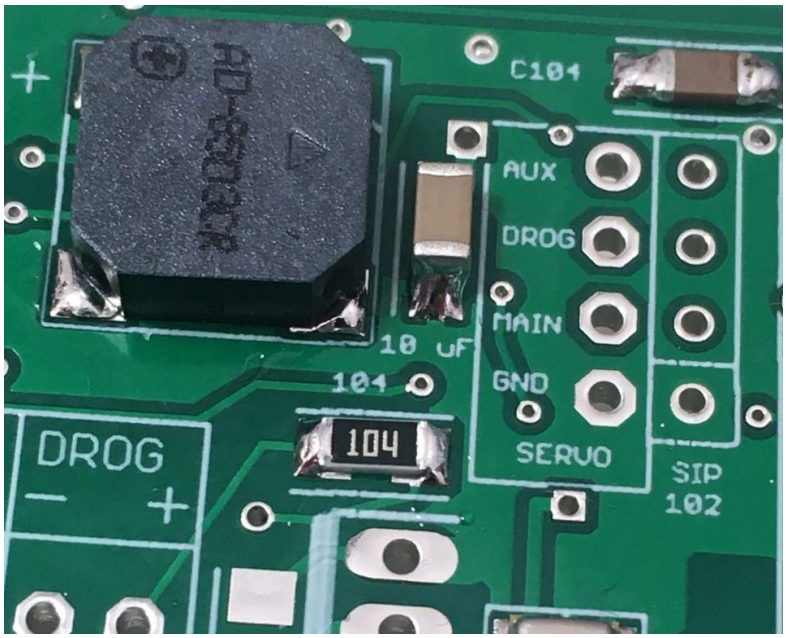
__ Mount the .1 uF capacitor (unmarked brown parts in PAPER tape)

Locate the spot for the .1 uF capacitor, next to the 10 uF capacitor that you just mounted, it's marked "C104" on the board. Solder into place.



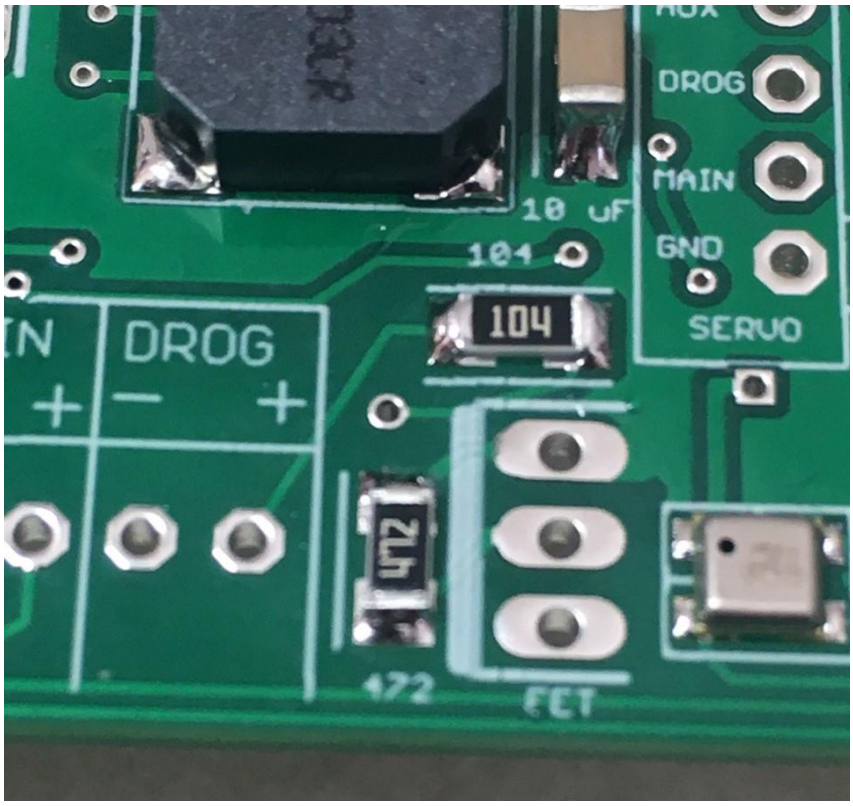
__ Mount the 100K resistor (marked "104")

Locate the spot for the 100K resistor in the center of the board, below the buzzer. Solder in place.



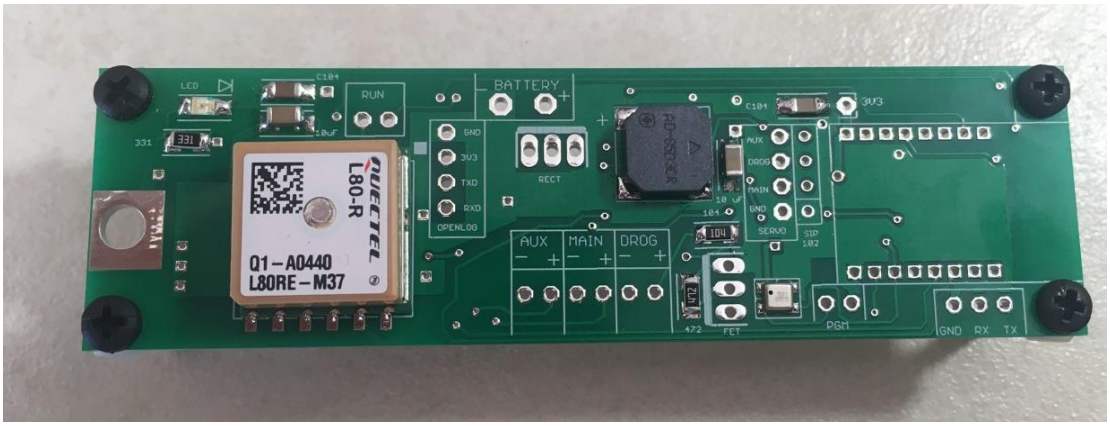
__ Mount the 4.7K resistor (marked “472”)

Locate the spot for the 4.7K resistor on the bottom-center edge of the board, to the left of the little silver baro pressure sensor. Solder into place.



That concludes the surface-mount parts on the top side of the board…

__ Inspect all the solder joints on the board, using a 10x jeweler’s loupe. They should all be nice and shiny, and the solder joints should clearly bridge the parts with the PC board pads. If you have any questionable joints, we recommend that you remove any excess solder with desoldering wick, and resolder.

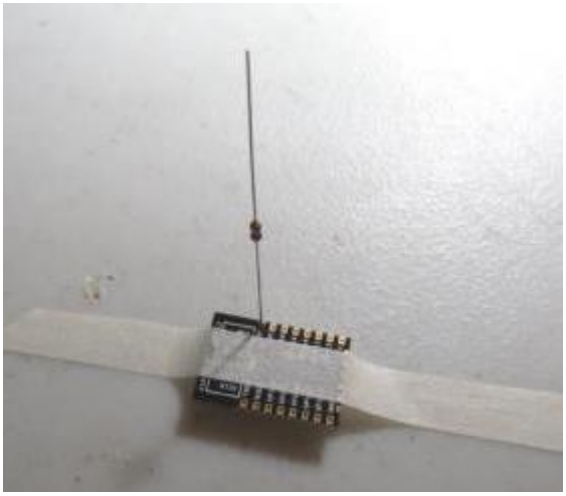


Mounting the ESP8266-12 WiFi Module

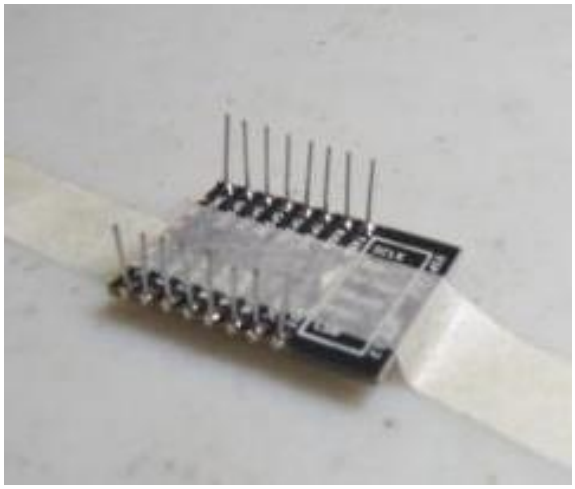
IMPORTANT NOTE: Mounting the WiFi Module correctly is a CRITICAL factor is getting your Quasar to work properly. Please read these directions carefully first. You will be soldering wires to the WiFi module to basically turn it into a through-hole part. DO NOT try to make it "easier" by soldering the pads directly to the PC board… you most likely will short out the WiFi module and damage it and/or other components on the board when you apply power!

Carefully remove the ESP8266-12 WiFi module from the antistatic baggie in which it was shipped. (Be sure to keep the baggie, it has the passkey that you'll need to connect to your WiFi device!) Note that one end has a "squiggly" line and sticks out, this is the antenna side, be sure to line it up with the left side of the PC board.

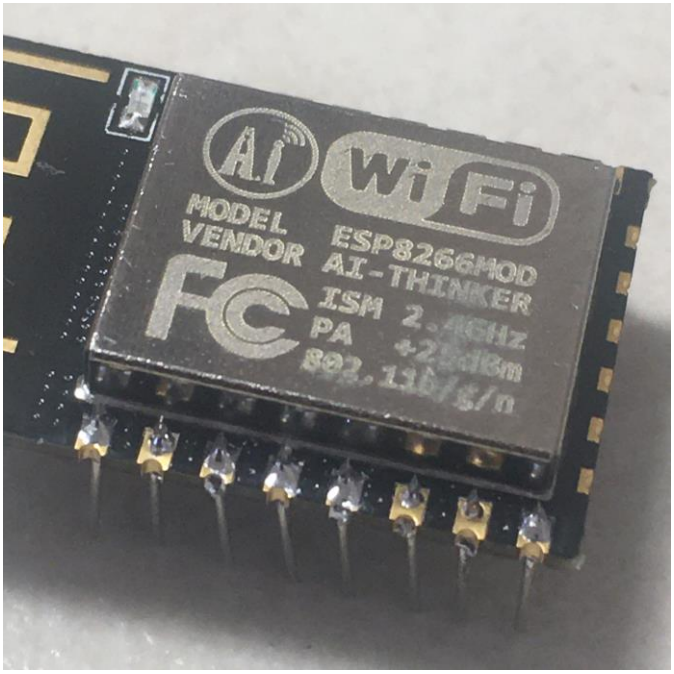
Cut a piece of paper masking tape about ¼" wide and 3" long. Tape the WiFi module to your work tape upside down, so that the metal shield is facing down. Take one of the 1/8W leaded resistors and put it into one of the corner holes of the WiFi module. Yes, it will stick up a lot. Solder the lead to the pad, holding the resistor straight up, then clip the lead off half-way to the resistor body. You don't need a lot of solder, just enough to fill the hole and ensure that the lead is well attached. Insert the resistor's leads into the next hole, and similarly solder it.



As you clip the resistors' leads, insert it into the next pad, then solder it to that pad. After the second lead on each side, clip it at the resistor body. When you are completely done, there will be a lead on each pad, about ½" long.

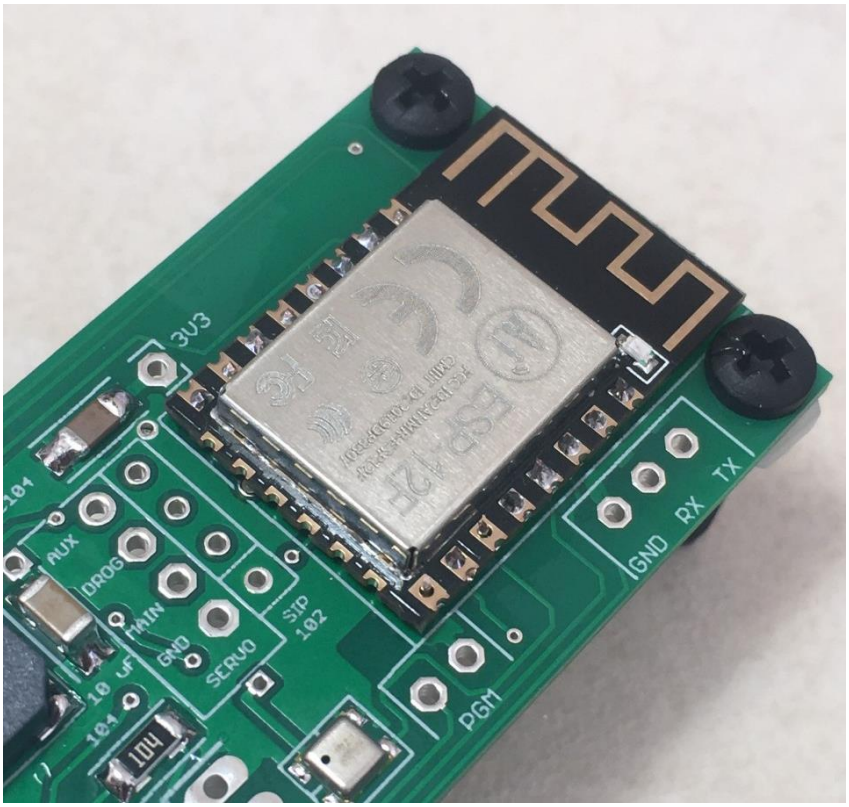


Untape the WiFi module from your work table and turn it over so that the TOP side (with the metal shield) is now up. You will have a short wire sticking out of each pad on the TOP of the WiFi module. With a pair of fine diagonal cutters, clip the stubby lead off close to the WiFi module's PC board. It doesn't matter if you have a little bit left, but it matters a lot if you wedge a little piece of the cut leads in the module somewhere, so inspect it carefully to make sure that they're all cut completely off.

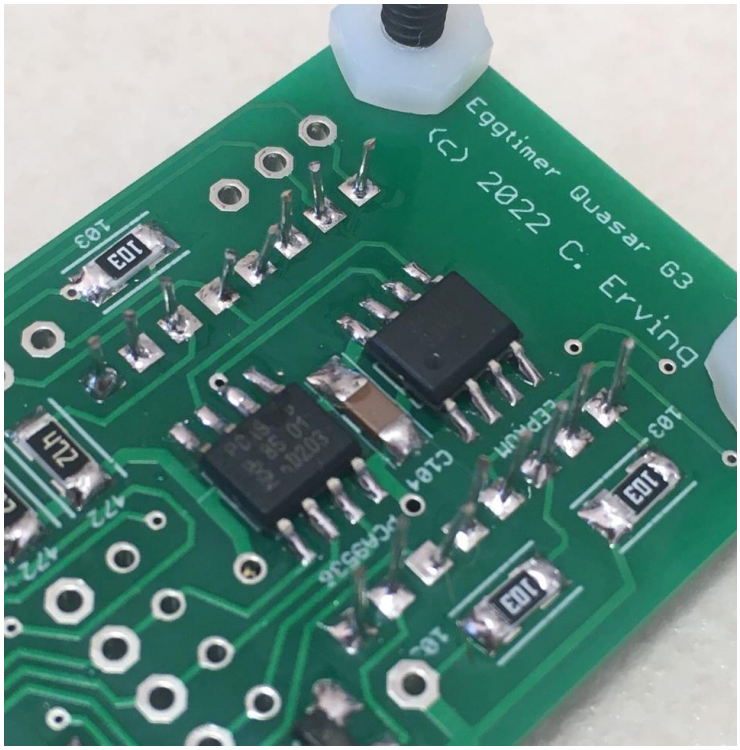


Afterwards, turn the WiFi module over, and with your diagonal pliers even out the leads so that they're the same length, about 3/8" long.

Carefully line up the leads with the holes for the WiFi module markings on the TOP of the PC board, and gently work it into the holes until it's about 1/32" above the board (about the thickness of a credit card). DO NOT try to mount the WiFi module flush with the PC board… you WANT it to stick up a little. This clearance will prevent "vias" on the PC board from shorting against the bottom of the WiFi module.



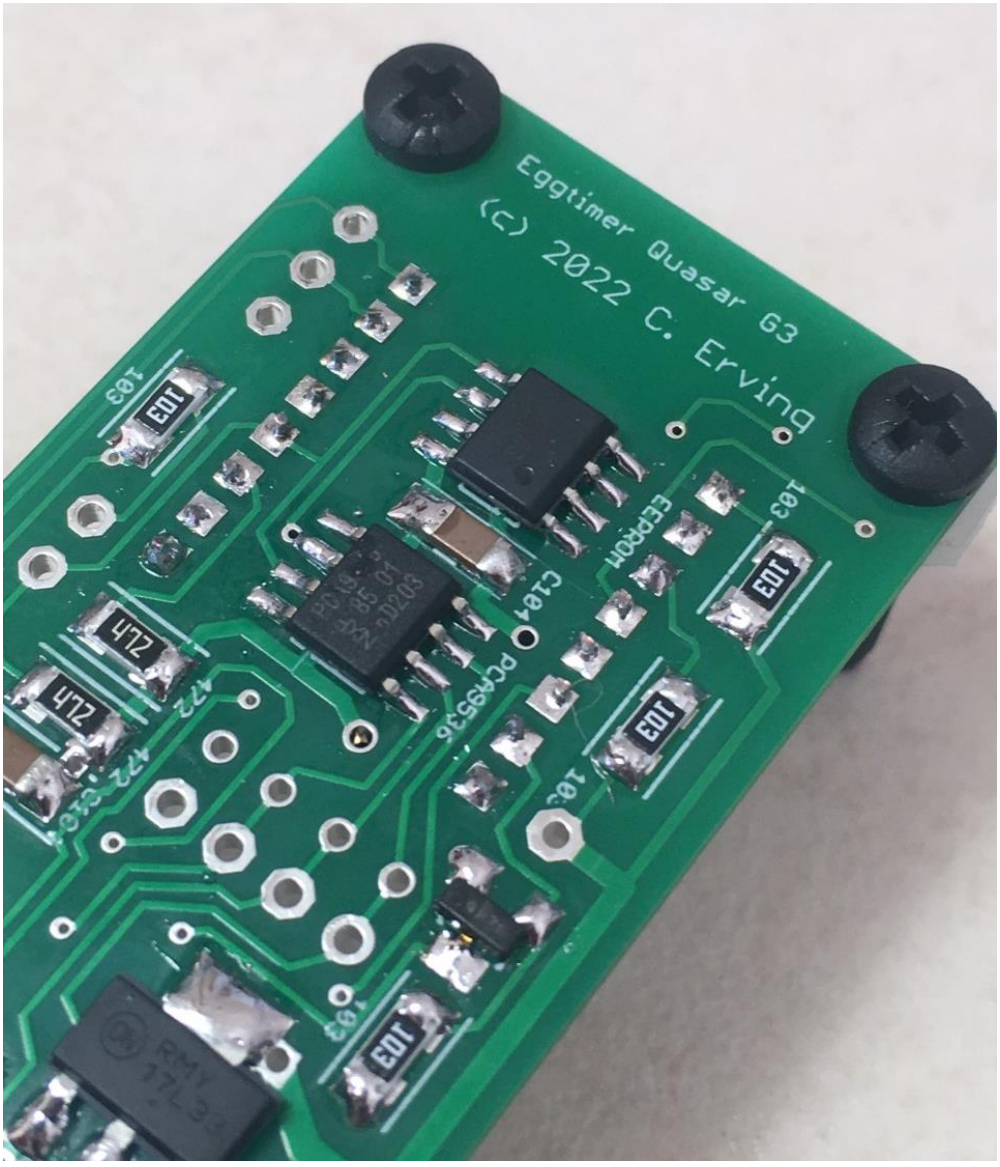
Now, turn the board over so the WiFi module is on the bottom. If you're not using a vise or PC board holder, reverse the screws so that the top of the board with the WiFi module is elevated from the table. Solder one lead from each side of the WiFi module to the board, turn it over and check to make sure that the WiFi module is even to the board. If it's not, heat up the joint(s) and even it out. Now you can solder the remaining leads to the board, use only enough solder to ensure that you have a good mechanical connection.



When you are done, all 16 pads (8 on each side) should be soldered on the bottom of the board, and all 16 pads on the WiFi module should be soldered. Inspect the solder joints carefully, and touch up any that look incomplete, particularly the two end corner pads… they provide the power and ground connections from the board.

Now, clip all of the leads from the bottom of the board, making sure that the stray clipped leads don't end up landing somewhere on the board or underneath a chip (that would be bad…).

Note: Your WiFi module may have six extra pads opposite the antenna, do not solder these or do anything at all with them.

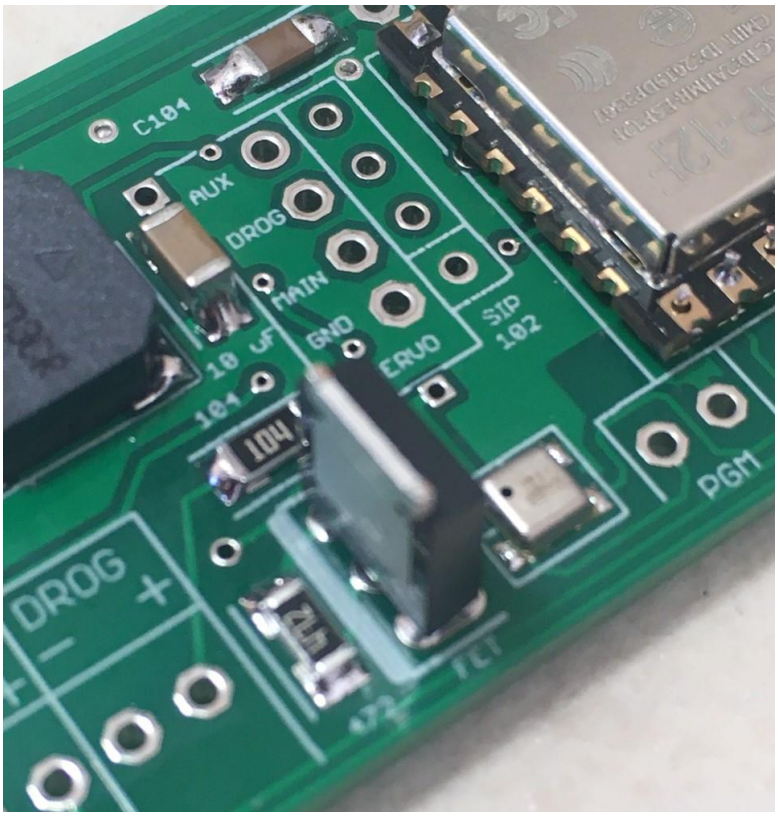


Mounting the Rest of the Top-Mount Parts

You will now be mounting the through-hole parts on the top side of the board, you will be soldering to the bottom of the board, so if you're using screws to elevate the board from the worktable, leave them as they were when you mounted the WiFi module (so they stick out from the top of the board).

__ Mount the Power MOSFET

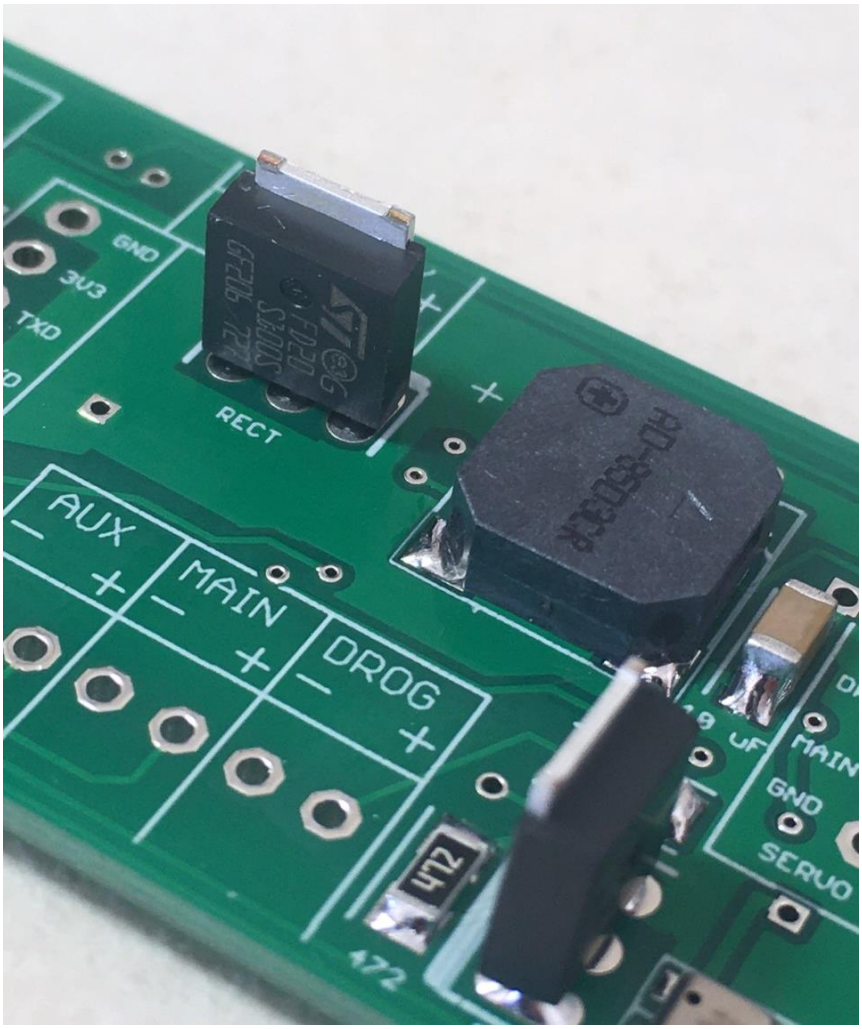
Locate the FQU13N06 MOSFET, it's a 3-pin part with a metal tab on one side. It's marked "FQU 13N06". Check the markings carefully… there are other parts that look similar, and if you get the wrong one things won't work! Locate the spot near the bottom-center of the board marked "FET", there are markings for the pads and the tab. Be sure to orient it correctly; the tab should be facing AWAY from the WiFi module, and should be on the side with the fat line marked on the PC board. Use some masking tape to hold it in place and keep it straight, then turn over the board and solder in place. Clip the leads flush.



__ Mount the Rectifier

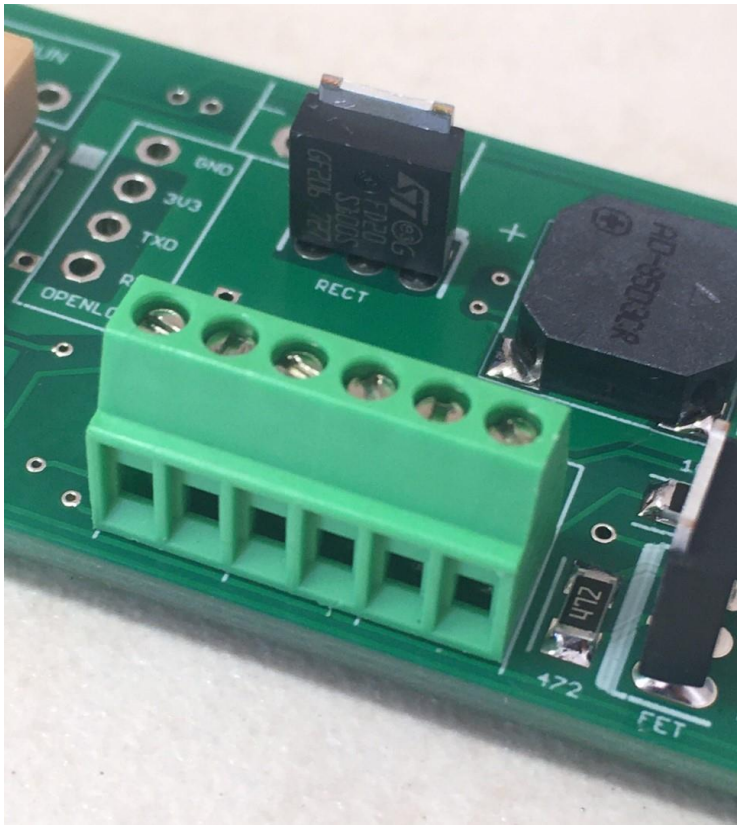
Locate the FERD20S100 recifier, it's a 3-pin part with a metal tab on one side. Check the markings carefully.. it's marked "FD20", there are other parts that look similar, so make sure you get the right ones. Do not interchange them… things will not work!

Mount it in the spot near the top-center of the board, with the tab facing the line at one end of the markings on the PC board… the tab should be facing the nearest edge of the PC board. Tape it in place to keep it upright and keep it from falling out, turn the board over and solder in place. Clip the leads flush.



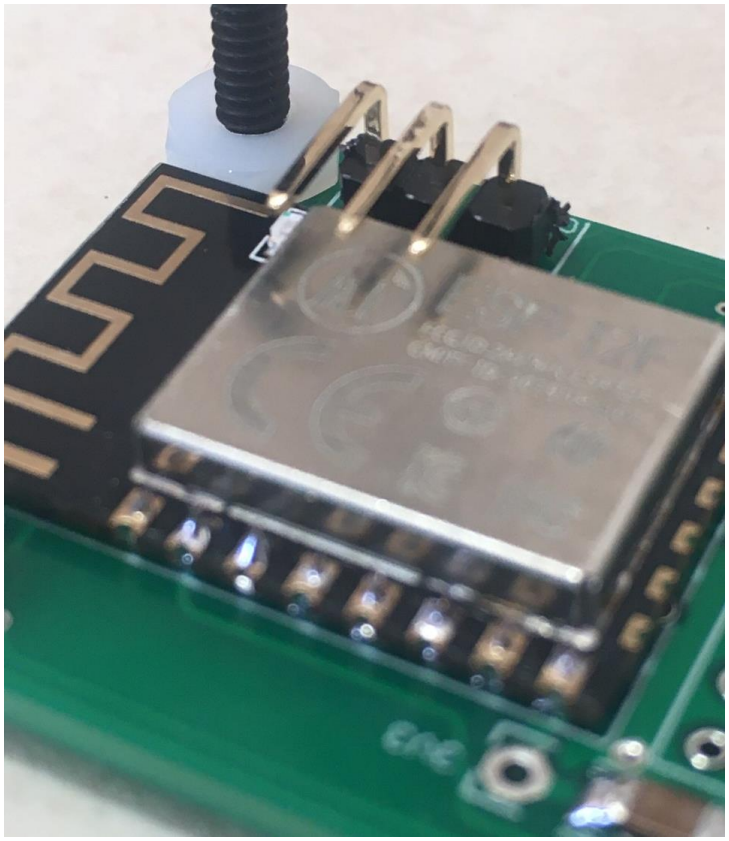
__ Mount the terminal block (Optional)

Locate the spot for the terminal block on the lower-center edge of the board. Place it in the holes, making sure that the side with the wire openings is facing outside. Tape into place, then turn over and solder the leads. Be generous with the solder… you need a good mechanical connection.



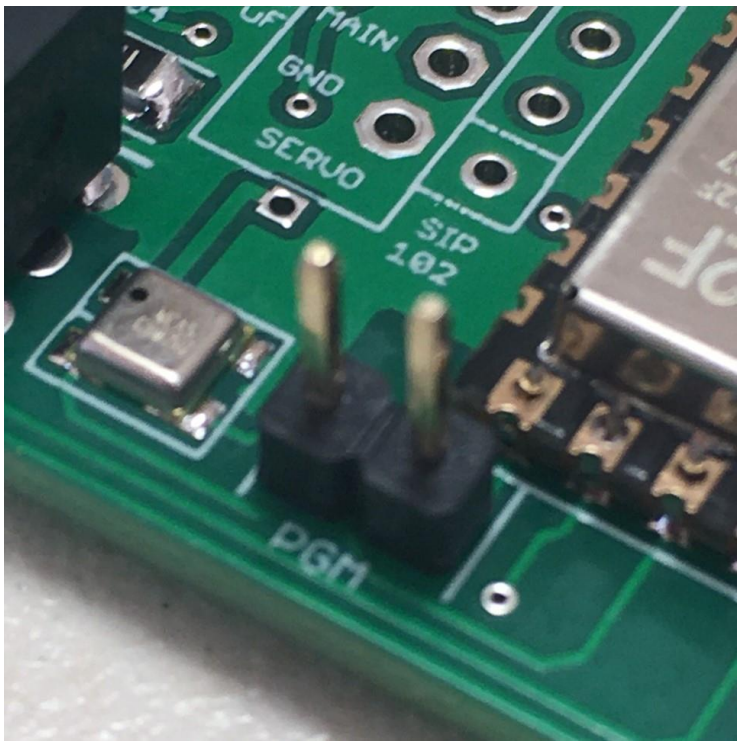
__ Mount the 3-pin right-angle header

Locate the spot for the 3-pin right-angle header, it's on the lower-right edge of the board just below the WiFi module. Place the 3-pin header so that the short end goes into the board, with the longer end facing inward, and tape into place so that the pins clear the metal can on the RF module by about 1/8". Turn over the board, and solder the pins to the bottom of the board.



__ Mount the PGM 2-pin header

Locate the spot for the PGM header pins, it's on the bottom edge of the board to the left of the 3-pin header that you just mounted and is marked "PGM" on the board. Take one of the 2-pin headers, and insert the short sided into the PC board, using some paper masking tape to hold it in place. Turn over the board and solder in place.



__ Mount the SIP resistor pack (4-pin package)

Locate the spot for the SIP resistor pack, it's four pads marked "SIP 102" next to the RF module. One end of the pads is marked with a square. If you look at the SIP, you'll see that there is a dot next to one end; this must match up with the square on the PC board. Hold the SIP into place with a piece of paper masking tape, then turn the board over and solder the pins in place.

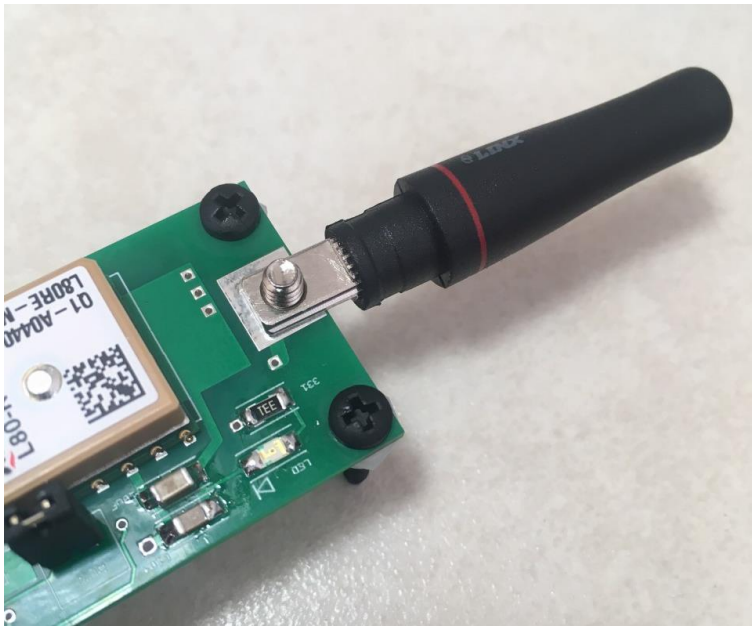
__ Mount the RUN 2-pin header

Locate the spot for the RUN header pins, it's on the top-left edge of the board just above the GPS module and is marked "RUN". Take one of the 2-pin headers, and insert the short sided into the PC board, using some paper masking tape to hold it in place. Turn over the board and solder in place.

Afterwards, put the shorting jumper on the RUN pins… this is REQUIRED for the GPS to work properly. The only time you won't have the jumper on the RUN pins is when you're updating the firmware, in which case it will go on the PGM pins.

___ Mount the antenna

Unscrew the screw from the antenna, and notice that the side with the screw head is offset from the other side. That side is going to go on the top side of the PC board. Place the antenna on the square pad, then insert the screw through the bottom of the board and tighten firmly.



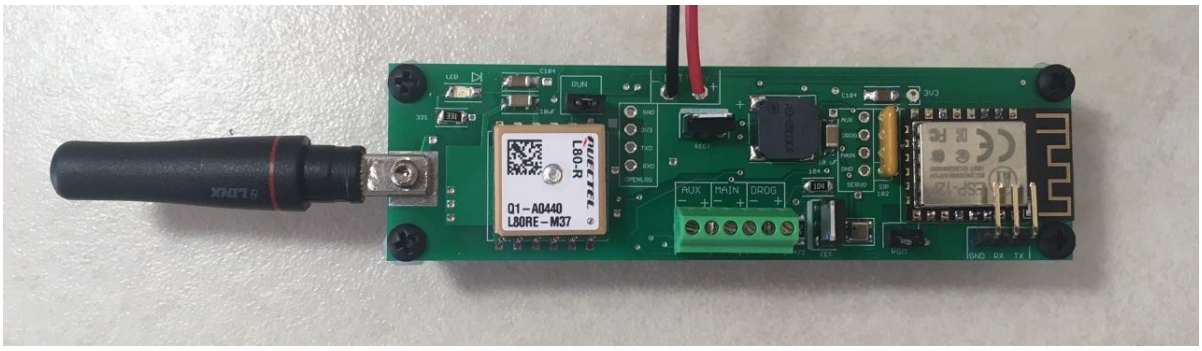
__ Connect your battery pigtail

Locate the two pads marked BATTERY on the top-center side of the board, those are the pads for the Quasar's battery. The Quasar requires a 2S LiPo battery to work properly. DO NOT, repeat, DO NOT use a 9V battery…it does not put out enough current to run the Quasar for very long, even though it may seem to work fine when you first connect it.

Almost all battery connectors have a RED wire on the "+" lead of the battery, and a BLACK wire on the "-" lead of the battery. If you are not sure which wire is which, connect your battery to the battery pigtail and use a DVM to check the polarity. Hint: Mark the "-" side of your battery pigtail with a black Sharpie marker… it will help you connect things in your AV bay, especially if you have other devices in it.

Solder your pigtail's "+" lead to the "BATTERY +" pad, and the pigtail's "-" lead to the "BATTERY – " pad.

Your Quasar is now finished… and ready for testing.



Preliminary Testing

Connect your 2S Lipo battery to the BATT pigtail. You should hear some quick beeps, then a long one. If you do not hear any beeps, immediately disconnect the battery and go to the troubleshooting section. Chances are pretty good that you have a solder bridge or an incomplete joint, so the first thing you need to do is to examine the board thoroughly with a magnifying glass. About 99% of all the problems that we see are due to soldering issues

When you connect the battery, you should see the RED light on the RF module blinking intermittently at about a 1 second interval. That's the GPS data being sent out, if you don't do anything at all it's going to start sending out GPS data to your Eggfinder LCD receiver at whatever frequency/ID it's programmed to (if you just built it, it's going to be the default… see the Quick Start Guide for the frequency/ID). If you leave it outside, you should see the orange LED next to the GPS module come on after a minute or so, that means that it's got a suitable satellite fix for tracking.

The Quasar acts like a WiFi access point and a server, you simply connect your WiFi-enabled device to it and browse to its home page (192.168.4.1), and voila! you get a web page that lets you configure your Quasar, download data, program the frequency/ID, perform deployment tests, etc.

Like any secured WiFi network, you need two things to connect… the SSID and the passkey. The SSID of your Quasar will be "Quasar_nnnnnn" where nnnn is the last 6 hexadecimal digits of your device's MAC address (a unique address given to every Ethernet device). The SSID is broadcast, so you should be able to see it in your device's WiFi manager.

The passkey is an eight-digit number generated by a random number algorithm the first time that your Quasar is powered on, and is saved in EEPROM memory at that time. It's going to be unique for every Quasar. There should be a label on the little baggie that the WiFi module came in with the passkey (you kept it, right?), but it's easy to get it if you lose it… see the section on Recoving the Passkey near the end of this manual.

Now, fire up your device's WiFi manager. You should see your Quasar's SSID on your WiFi manager, it will start with "Quasar". Connect to the SSID using the passkey that you obtained earlier (but don't put the space between the digits!). Set your browser to the address 192.168.4.1, and you should see the Quasar's status page. You're now connected to your Quasar, and ready to start using it.

Get out the Eggtimer Quasar User's Guide and start reading… if you can't stand to wait that long, you can cheat by going to the Eggtimer Quasar Quickstart Guide at the end, but we're sure that you'll want to read the long version for all the information… 😊

Mounting the Quasar in Your AV Bay

The Quasar has four #4 holes for mounting in a AV bay sled. The board is about 4" x 1.25" and the antenna adds about 1 ½" to the length, so you'll need to make sure that you have enough room on your sled for it. It will fit just fine in most rockets with 6" sleds, but of course the more room you have the better. It doesn't matter which way you mount it, as long as it's mounted so the GPS module is facing outwards. There's a drilling template on the Eggtimer Rocketry web site, we recommend that you download it, print it, and cut it out with scissors so you can drill the mounting holes accurately.

Our first choice for mounting hardware is to use #4 Nylon screws and nuts. They're non-conductive so you don't have to worry about shorts, and in the event of a crash they will actually shear, taking the load off the PC board and absorbing the shock.. With metal hardware, the PC board is going to take the full brunt of the impact and damage is more likely.

If you do use metal hardware, we recommend using #4 machine screws about 3/4" long, with #4 nylon washers to act as a spacer between the top of the PC board and the screw heads, and a ¼" nylon space between the bottom of the Quasar board and the sled. That keeps metal from touching the board directly, and keeps the components on the bottom of the board from contacting the sled. We recommend using nylon-insert nuts… they don't work loose. If you mount it like this, you can pretty much use whatever monster motor you may have on-hand (like the infamous O5800, for example) without fear of anything coming loose.

You MUST use non-metallic spacers between the bottom of the board and your sled. Since some parts are mounted on the bottom of the board, it's possible to damage your Quasar if you screw it down directly to the sled, doing that may break solder joints or even a lead on the IC if it's forced against the sled.

We generally recommend that you try to mount the Quasar as close to the battery as possible, and keep the wiring as short as possible. Small zip ties work really well for tidying up the wires. Also, we **strongly** recommend that you zip tie the wires connected to the Quasar to your sled, to provide strain relief for them. In general, if a wire can't move, it won't come loose. Enough said…

Note that large bits of metal in your AV bay will reduce the range of your Quasar, as will metallic paint or carbon fiber body tubes. In most cases, the range will be good enough for you to be able to operate the Quasar from a reasonable distance close to the rocket, maybe 10'-20', but you need to be aware of this in case you're thinking that you can arm your 75mm minimum-diameter carbon fiber machbuster sitting on the away pad from the LCO's table… it ain't gonna happen. Similarly, your GPS radio range may be reduced if you have metal allthreads in your AV bay, however for most hobby rocketry flights it's not going to be enough to make much difference in the range.

If you are using stranded wire, you should tin just the very end of the wires to prevent them from fraying; a loose strand of wire can short out the battery, which can cause a fire if you're using LiPo batteries, so check your connections carefully to make sure that there are no shorts.

For a flight, we strongly recommend that you zip-tie any and all connections to the sled next to the pads/terminals. This prevents wires from pulling out of the screw terminals due to G forces. Similarly, you should tape closed any connectors, and zip-tie any loose wires to the sled. If it can't move, it can't come loose…

Troubleshooting

If your Eggtimer Quasar 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, or with a 10x jeweler's loupe or magnifier, and make sure that all of the parts are in the right place. 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. Most of the holes and 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 desoldering 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 solder splatter will almost always cause more damage than the original solder bridge. "Canned air" is actually a refrigerant, and the cold shock can damage electronic components too.

Another thing to look out for is "cold" solder joints, they look dull and blobby compared to a nice shiny "tented" solder joint. Cold solder joints won't conduct well; at the low power that the Quasar 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 a vacuum bulb to remove the excess, then heat it up and resolder the joint.

Check Your Component Polarity

Most of the small 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. Some of the components are not symmetrical (i.e. the voltage regulators) so they would be difficult to install backwards, too. However, things like the 8-pin memory and driver IC's can be installed backwards… and will cause you a lot of pain if you do so.

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 Eggtimer Quasar 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.

If It Still Doesn't Work…

There is, of course, always an outside chance that you have a bad component. We pre-program and test every WiFi module, and the other parts are factory-direct so the likelihood that one of them is bad is very small. 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)

No power-on beeps when you connect the battery

- Battery polarity backwards
- Bad solder joint on voltage regulator
- Bad solder joint on FERD20 rectifier
- Bad solder joint on 10 uF capacitors
- Bad solder joint on the ESP8266-12 module
- Buzzer not mounted properly
- Bad solder joint on SI2302 FET or 103 resistor next to it
- Weak battery (2S Lipo required… don't even try a 9V alkaline battery!)

No data when I connect the USB-Serial cable

- Serial cable connected incorrectly
- Terminal program not configured correctly
  (should be 9600 baud, 8 bits, no parity, 1 stop bit)
- Bad solder joint on ESP8266-12 module
- Bad solder joint on header

Don't see a "Quasar_…" SSID

- Bad solder joint on ESP8266-12 module
- Weak 2S Lipo battery (DON'T use a 9V alkaline battery!)

Can't connect to "Quasar…" SSID

- Bad passkey (hook up the serial cable and check it)
- Wrong type/encryption selected
  (set them all to "auto" and let your WiFi manager pick it up)

Can't bring up Quasar web page

- Bad WiFi connection (check your WiFi manager)
- Incorrect URL (use **http://192.168.4.1** and bookmark it!)
- Weak battery (use a freshly charged one)
- Bad solder joint on the ESP8266-12 module
- Problem with the two 4.7K resistors next to the baro sensor
- CAT24C512 EEPROM mounted incorrectly

Drogue/Main continuity won't work

- Bad solder joint on the ESP8266-12 module
- Bad solder joint on the VN5E160S drivers (#1 reason!)
- Bad solder joint on the 104 resistors
- Weak battery, or no power to the deployments

Drogue/Main channels won't fire when I do a test

- Bad solder joint on the ESP8266-12 module
- Bad solder joint on the VN5E160S drivres (#1 reason!)
- Bad solder joint on the 104 resistors
- Bad solder joint and/or reversed FQU13N06 MOSFET
- Weak battery, or no power to the deployments

Recovering the Passkey

If you lose the passkey, don't panic. You can easily retrieve it by connecting a USB-Serial cable (the same cable that's used with all Eggtimer Rocketry products) to the 3-pin header as follows:

BLACK wire (GND) – GND
WHITE wire (RXD) – TX
GREEN wire (TXD) – not used

Using an ASCII terminal program such as PuTTY, connect to the serial port at 9600 baud, 8 bits, no parity, 1 stop bit. Now connect the battery on your Quasar. You should see the following information:

```
(a few lines of garbage… part of the boot process)
          Quasar v1.01c
          Default SSID: Quasar_F87A6E
          PASSKEY:  3718 6501

(more stuff after this, but this is all we need..)
```

Note that there is a space between the first four digits of the passkey and the second four digits, that's just to make it easier to read; when you actually enter the passkey don't type the space.

Disconnect the battery, and remove the serial cable. You won't need the cable again unless you forget the passkey, or you need to flash the software. We recommend that you write the passkey on a piece of masking tape, and put that on top of the WiFi module. That can come in handy if you're swapping altimeters between rockets.

Shockproofing Your Eggtimer Quasar

Most of the components on the Eggtimer Quasar are extremely robust and can easily handle the normal shocks that occur in rocketry, even hard landings (such as when the parachute reefs or doesn't quite come out of the body tube). However, the antenna on the GPS module is connected to the module using some special conductive double-stick tape, with a single solder joint in the middle. They have been known to break loose with hard impacts, so we recommend that you run a bead of good epoxy (RocketPoxy, West Systems, etc.) along the side of the antenna, on the two sides that do NOT have the solder joints.

The epoxy bead does not need to be super thick… you just want to glue the antenna to the metal "can" on the GPS module, if some of the glue wicks down to the PC board that's OK, but the goal is to glue the antenna to the metal can, not the module to the board. See the pictures below. Also, be careful not to get epoxy on the four pads for the OpenLog header; we recommend that you use some masking tape to cover the pads until the glue gels.

Eggtimer Quasar Limited Warranty

Eggtimer Rocketry warrants that all of the parts listed in the parts list necessary to build the Eggtimer Quasar are included in the kit, and that they are all new and working. We don't use surplus parts… we like stuff that we know will work. If you open up the package and find that something is missing, send us an email at support@eggtimerrocketry.com letting us know, and we'll get it taken care of right away.

Eggtimer Rocketry warrants that when constructed per the documented assembly procedure the Eggtimer Quasar will perform substantially per the instructions. We try very hard to make sure that our stuff works the way we say it does, but because software isn't perfect we can't always anticipate things that may occur. If we find that there is a problem that prevents the Quasar from operating as documented, we'll do our best to fix it in a timely manner.

Since there is a wide variation of possible configurations using the Eggtimer Quasar and there is no way that we could possibly test them all, we do not warrant the suitability of the Eggtimer Quasar for any particular purpose. Hobby Rocketry is just that…a hobby. It's up to you to decide how to use our products, and whether or not they are suitable for your projects.

Eggtimer Quasar Quick Start Guide

Power: 7.4v/2S LiPo, 500 mAH or higher recommended. Bigger mAH's is Better…

Current Draw: About 110 mA when idle, 230 mA when armed for flight and transmitting

Outputs:

Drogue: Connect to DROG terminals
Main: Connect to MAIN terminals
AUX: For airstarts, etc…
Servo: Logic-level outputs for servos, or interfacing to low-current devices

WiFi Connection

Select the "Quasar_xxxxx" SSID (or your custom SSID if you set one), and use the passkey that was on the WiFi module's envelope (you did save it, right?), or recover the passkey using the data cable (see Appendix E for instructions)

Set your browser to **192.168.4.1** to open the Status Page…bookmark it for later use!

If asked, tell your device to "keep the connection" even though there's no Internet

Status Page

Displays:

SSID and Software Version
Radio Regulatory Domain and Frequency/ID

Status (Disarmed, normally)
Validation Code (for arming)
Arming Button

Drogue Settings
Main Settings
AUX Settings

GPS Status
GPS Coordinates

Battery Voltage/Percentage
ASL altitude
Temperature in F

Drogue Settings

Click on Change link next to Drogue settings to change

Delay: OFF, 0.1-9.0 secs by 0.1 secs, 3-30 secs by 1 sec.
Descent Samples/sec
Drogue mode (igniter/servo)
Drogue on-time or servo direction/skew

Main Settings

Deployment Altitude:
OFF, Nose-Over, 50'-500' by 50', 500'-3,000' by 100'
Main Mode (igniter/servo)
Main on-time or servo direction/skew
FailSafe:
Velocity: OFF, 50-200 ft/sec by 25 ft/sec
Time: 50-3000 ms by 25 ms

Global Settings

Click on the Settings link on the Status Page to change:
LDA – Launch Detect Altitude
Launch samples/sec
Auto-Arm (OFF/ON)
Name (sent out telemetry port with other data,
use your Ham call sign if you're using the 70cm Ham version)
Link to Hardware Setup Menu

Hardware Setup Menu

Voltage Offset: Reported Voltage – Actual Battery Voltage (0.0-0.9v)
Tone: Buzzer pitch (Low, Medium, High)
Frequency/ID display, with Change link
SSID: Custom WiFi SSID (A-Z,a-z,0-9, and underscore), 8-14 characters
Power-cycle your Quasar to apply the new SSID

Arming

Remote Arming:
Select the proper flight settings
Verify that all enabled outputs are ON or greyed out (n/a)
Enter the 4-digit validation code, then click ARM
When the "Armed" page displays, CLOSE YOUR BROWSER
It wouldn't hurt to turn off your device's WiFi, either.

Auto-Arm (if enabled in the Global Settings menu):
Quasar will arm itself 60 seconds after power-on, if channels pass continuity check

Disarming (for aborted flight)

Connect to the Status page (192.168.4.1) (this may take several seconds)
Enter the 4-digit validation code, then click DISARM
Wait for the normal Status Page… if it takes more than 10 seconds, refresh your browser

Downloading Flight Status Data

Click on the Flights link on the Status Page
Click on the 'More' link next to the flight
View the Flight Summary data…
For detail .csv download, click on the 'Detail' link at the bottom of the Flight Summary page

Deployment Channel Testing

Check your Settings first, set appropriately
Go to the test page… **192.168.4.1/test**
Select the channel to fire… it uses the settings from the Global Settings page
Enter the 4-digit validation code then click TEST
To abort a test, close the page before it counts down to zero

Using the QUASAR with the Eggfinder LCD receiver

Coordinate Display

Latitude <Time since Fix> <Drogue status><Main Status>
Longitude <Current AGL Altitude>

Compass Display

<compass heading> <Time since Fix>
<distance to rocket>

Navigation Display (with LCD-GPS Module only)

<degrees to rocket. <Time since Fix>
<distance to rocket>