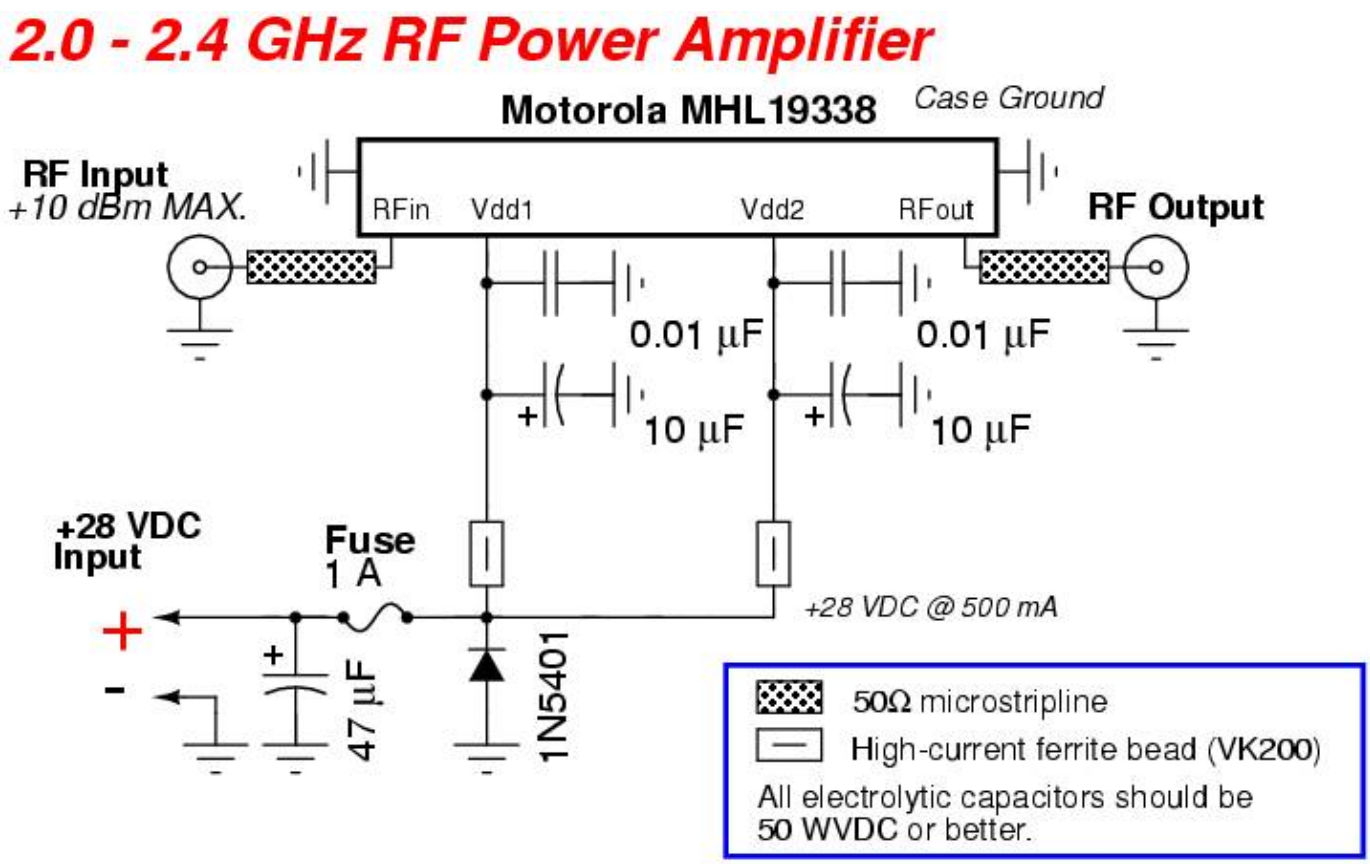
4 Watt RF Power Amplifier for 2 GHz

Overview

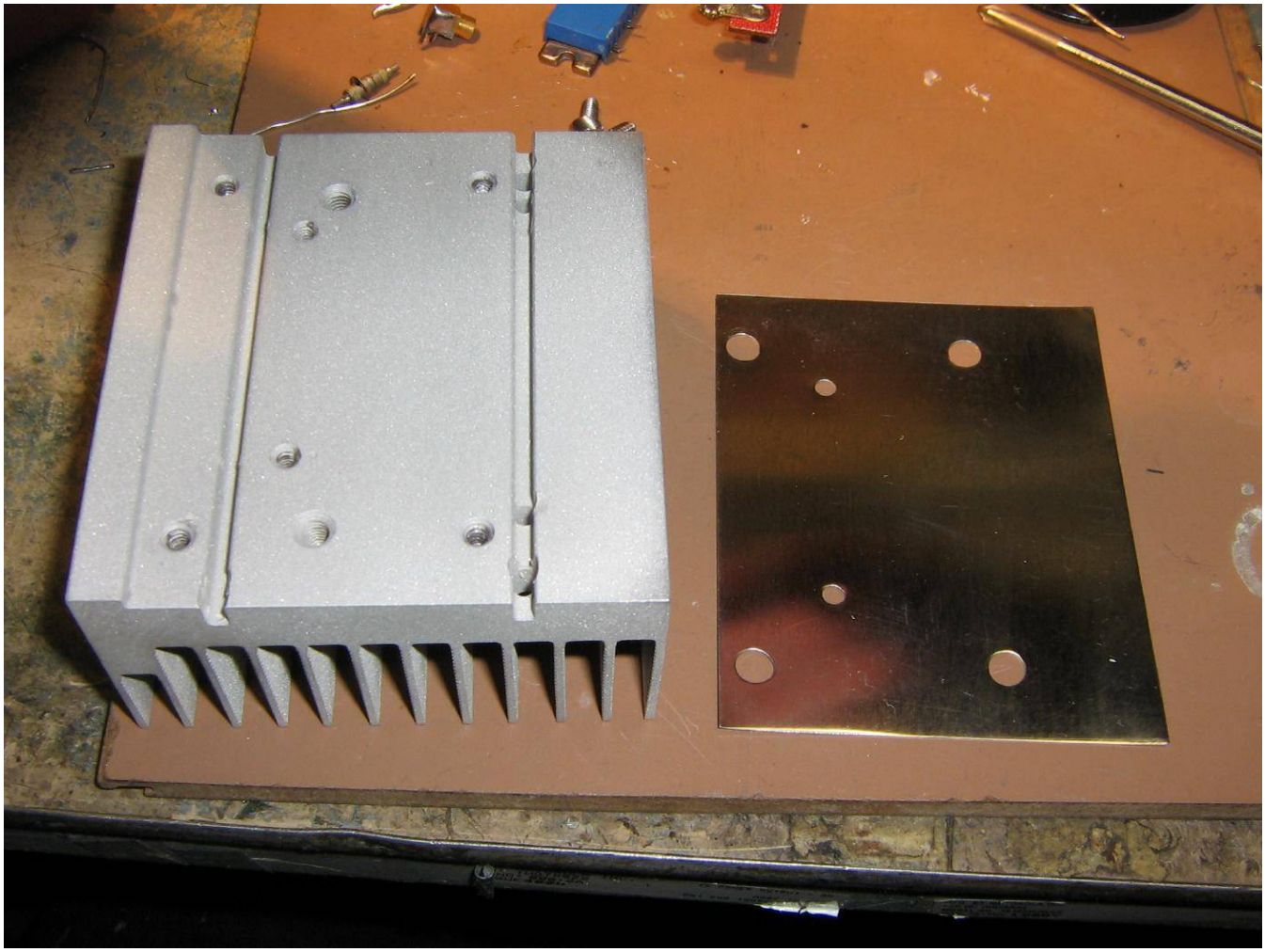
This is a redesign of the Motorola MHL19338–based 4 watt, 2.0 GHz range amplifier from *GBPPR 'Zine*, Issue #52. I noticed that when this amplifier module is operating on "out–of–band" frequencies, the operation wasn't very stable. This could be attributed to the module's heatsink tab (ground) to circuit board connections, which need to have a *very* low inductance path to ground. This can be difficult to accomplish using standard PC board materials and construction techniques.

This newer version uses a layout which will eliminate the need for a PC board altogether. The hybrid power module and its passive supporting components will be mounted, and soldered directly, to a piece of tin plate (K&S Metal #254), which is then attached to the aluminum heatsink. This provides both a rugged, physically stable, amplifier base and a low inductance RF ground path.

Schematic



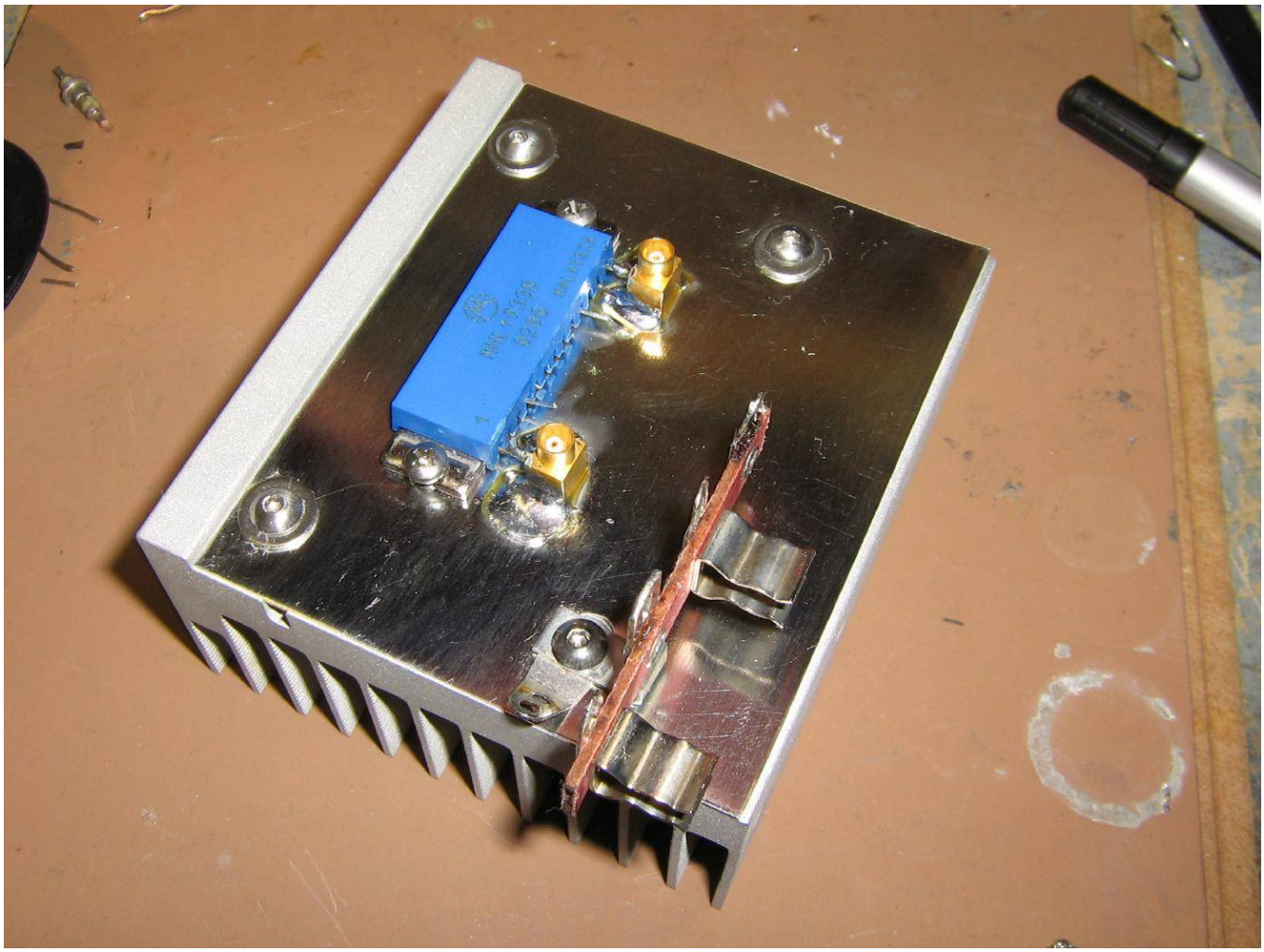
Pictures & Construction Notes



The aluminum heatsink (left) and the K&S Metal #254 tin sheet.

The aluminum heatsink already has the necessary mounting holes drilled and tapped.

Two #6 stainless steel screws will secure the MHL19338 to the heatsink and tin sheet. Four #8 stainless steel screws with washers will secure the tin sheet to the heatsink.

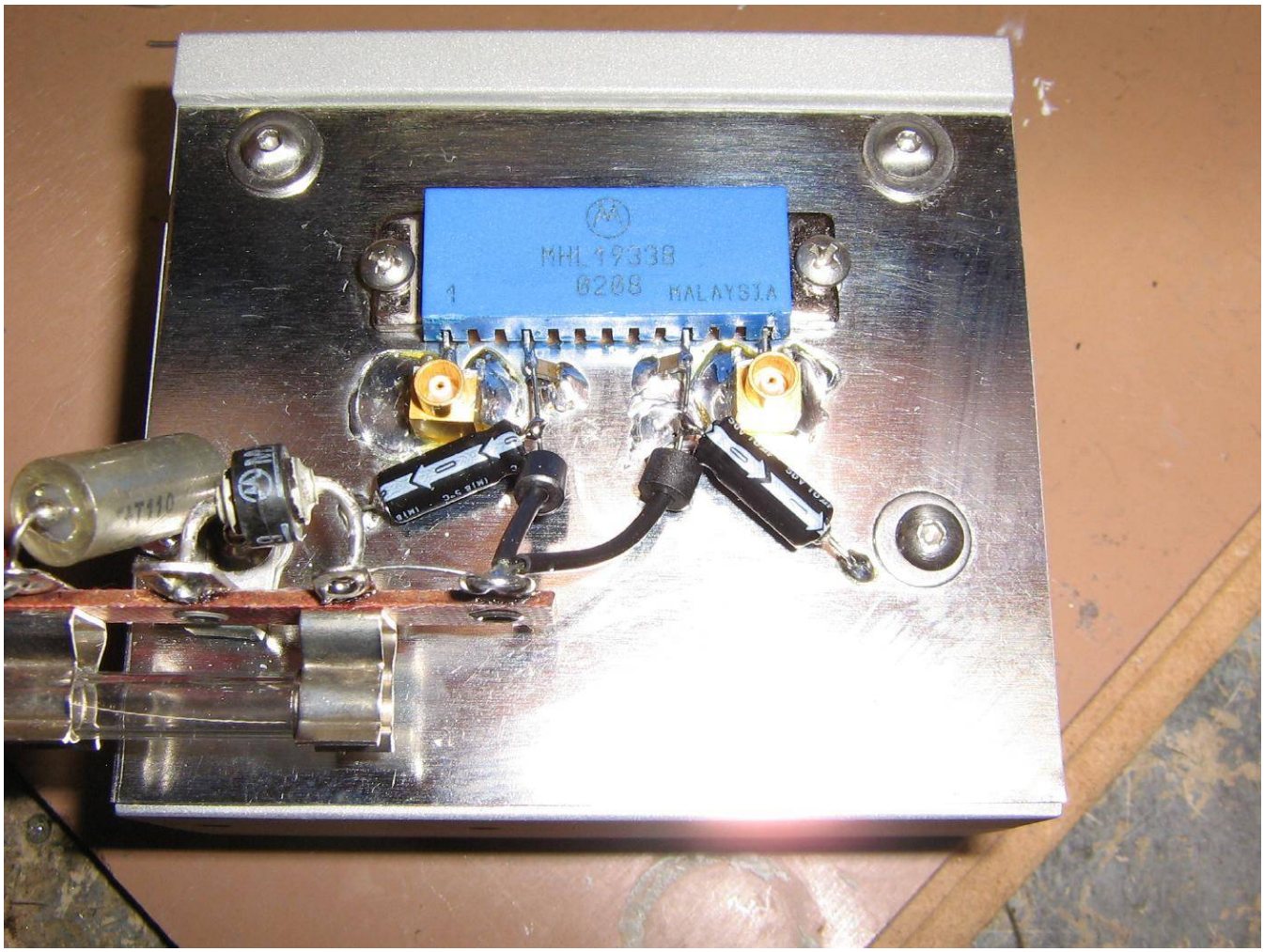


Attach the tin sheet to the heatsink using the proper hardware. Be sure the tin plate fits the heatsink and that there are no air gaps.

Next, you can attach the MHL19338 to the heatsink. No thermal paste was used, as that can also lead to RF stability problems. We'll be cooling the MHL19338 using only passive means in this application. Be sure to not overtighten the MHL19338's mounting screws or you can break the delicate circuit board inside the module itself.

On the RF output and input pins, solder two right−angle MCX or SMA connectors directly to the tin sheet, with the RF connector's center pin connected to the MHL19338's respective pin. This process will require a substantial amount of heat, so use a fairly large solder iron, but try to minimize the amount of time spent heating the general area.

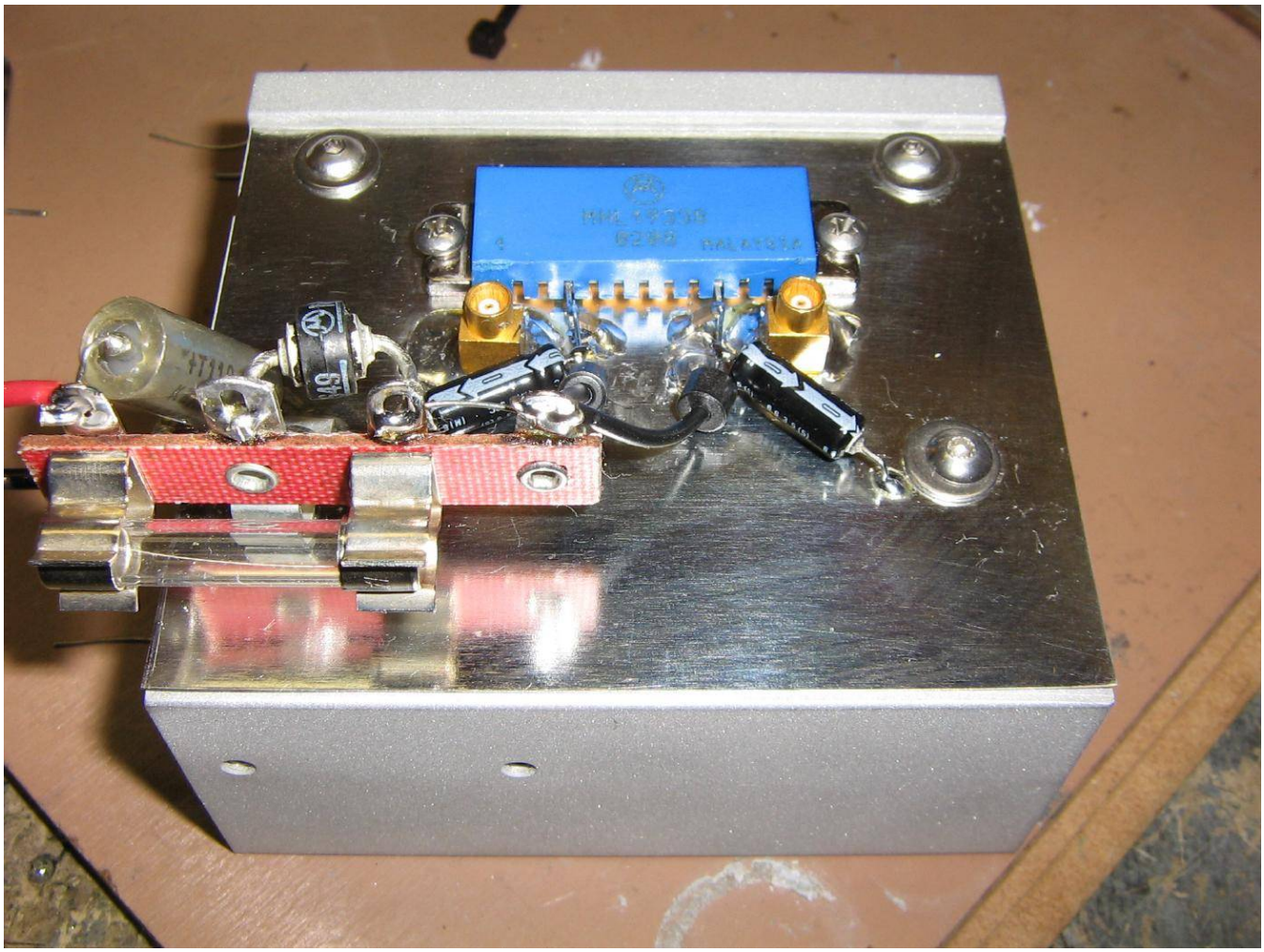
An optional solder terminal block, with a built−in fuse holder, was added to mount the +28 VDC power supply connections to.



Attach the rest of the passive components.

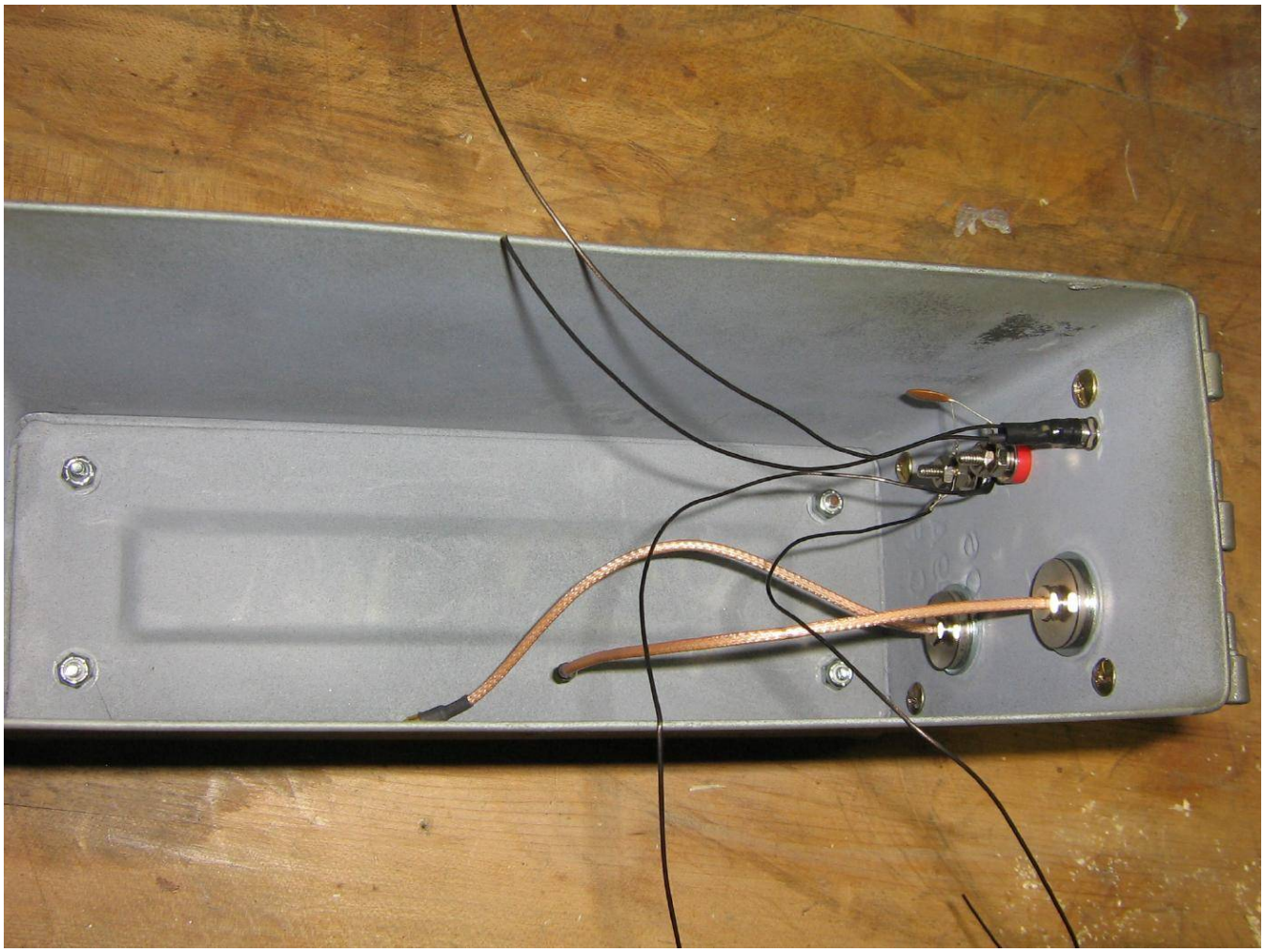
You can kinda see the two little brown SMT 0.01 µF capacitors attached from the MHL19338's V_{dd} pins to the ground plane.

The solder terminal strip acts as a common tie point for the +28 VDC power supply lines. The large diode is for polarity protection. The 1 amp fuse is for current protection.



Alternate view.

The two large black round things on the MHL19338's V_{dd} power lines are ferrite beads.

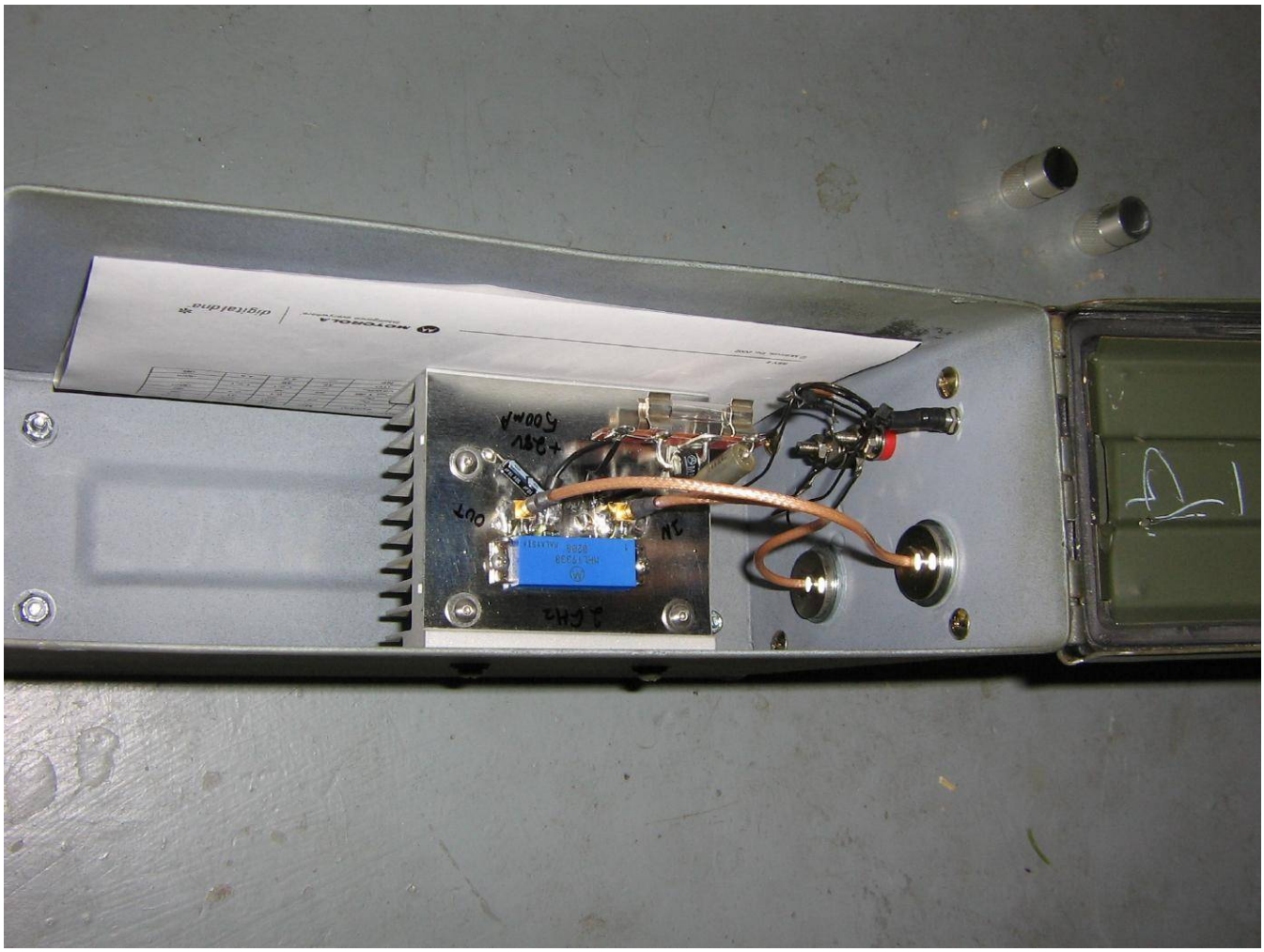


Construction of the ammo box case for this project.

The +28 VDC power input will come in via two banana jacks with a 0.01 µF ceramic bypass capacitor them at the input.

A panel−mounted power−indicated green LED is above that.

The RF input and output will be via two panel−mounted N jacks with MCX plug connections.



Mounting the amplifer and heatsink like so.

The heatsink should technically be mounted fins *up*, but this amplifier doesn't get that hot, and the case it's attached to helps to draw away excess heat.

A copy of the MHL19338 data sheet is included in the case.

Outside case overview.

This amplifier will do an easy four watts at around 2 GHz with a 10 mW drive, and will now be much more stable when operating out–of–band, even on GPS frequencies! Hehee...

Here is a chart of the RF power output of this particular amplifier when driven with a Micronetics M3500–1324 at around +5 dBm. The output RF power was measured on a Bird APM–16 RF power meter using a 5 watt 1.7–2.2 GHz APM–5L slug.

Frequency (MHz)	**RF Power Output (Watts)**	
1575	1.3	(L1 GPS)
1650	2.1	
1700	2.6	
1750	3.0	
1800	3.3	
1850	3.5	
1900	3.7	
1950	4.0	
2000	3.7	
2050	3.5	
2100	3.4	
2150	3.4	
2200	2.4	
2250	2.0	
2300	1.0	(Ham Band)
2350	0.9	
2400	0.8	(Ham Band)
2450	0.5	(Ham Band)
2500	0.1	