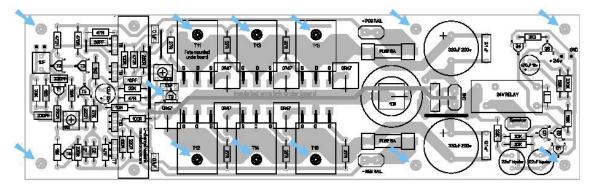
Construction Guide – Nmos350 & Nmos500 power amp modules

The following is a guide only and is not intended to cover all variations of construction that may be employed by other hobbyists. It assumes that the constructor has adequate skills to assemble a moderately complex PCB and has basic skills in the use of tools. The guide begins with an un-drilled but otherwise finished blank PCB.

The PCB

All holes of the PCB should be pre-drilled with a 0.8mm bit. Many of these holes will be drilled again later to accommodate the various component lead sizes. When this is complete rub the track side of the board gently with some fine steel wool to de-burr the holes.

Before re-drilling and placing any components you need to use the PCB as a template to mark the heatsink for drilling. This is done by placing the PCB, tracks down onto the heatsink and securing firmly with clamps or strong tape. Use the PCB to mark the drilling holes for the power FET screw holes and the PCB mounts (shown with blue arrows). I used the same 0.8mm bit to provide a "drill" centre for future drilling. Also mark the hole for T8 the "heat sense" transistor.



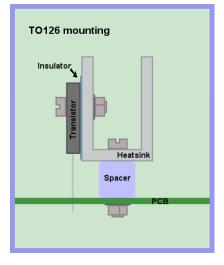
Remove the board and re-drill the holes that will take the larger components. I.e. the FETs, larger capacitors, fuse holders and 5-watt resistors etc. All holes should be correctly drilled before you begin to load the PCB with components. The PCB holes required for the FETs should be the same diameter as the FET mounting hole. Using the board again as a guide make the heatsink for the 4 TO126 transistors. I used a piece of U channel aluminium measuring 64mm long x 12mm wide.

Mark and drill the 2 PCB mounting holes plus the 4 transistor mounting holes. De-burr all the holes well.

Before components are placed onto the PCB, the tracks should be cleaned well using a small amount of detergent and some fine steel wool (or other abrasive cleaner) then rinsed.

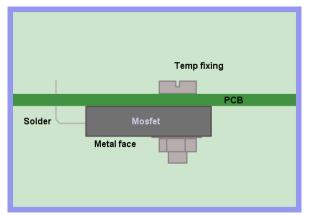
Assemble the PCB starting with the wire links, the small resistors, the fuse holders and all the PCB connectors. Then mount the 2 trimmer resistors, all the capacitors and the relay. Then mount all the TO92 transistors except T8.

Assemble the 4 TO126 transistors to the small heatsink being mindful of their locations on the PCB. Use the drawing as a guide. Carefully mount the assembly onto the PCB using spacers to raise the heatsink about 6mm. Note there are components underneath that should not be in contact the heatsink. Once the transistor leads are passed through the



PCB tighten all the screws. Before you solder check there are no shorts between the heatsink and the collector of each transistor. If there is, disassemble and check the insulating pads and heatsink for burrs or damage. Finally solder all the transistor leads.

The next job is to mount the power FETs. These mount underneath the PCB and involve the use of temporary nuts and bolts to align and secure them prior to soldering. Failure to do this correctly could cause a FET to fracture when PCB is secured to the heatsink. The temporary screws need to be a snug fit so that the FET holes align well with the PCB holes.



- Measure and bend the FET leads so that they pass through the PCB solder holes and the FET mounting hole aligns with the PCB hole. Note that the metal side of the FET faces the heatsink with the leads bent in the opposite direction.
- 2. Secure the FETs using the temporary nuts and bolts and tighten taking care that the FETs remain in position.
- 3. Check to see that the plastic side of the FET is hard against the PCB then solder all the leads. Remove the nuts and bolts.

Finally solder the long insulated link connecting the 2 PCB ground points. Solder only at the points shown.

Examine the board looking for errors and the tracks for any unintentional shorts between tracks or poorly soldered joints. Your PCB is finished.

The Heatsink

Using the centre holes marked earlier, drill and tap the heatsink to take whatever mounting bolts you intend to use. Fine thread self tapping screws can also be used. Completely de-burr all the holes using a countersink bit or larger drill bit. This prevents any metal that de-forms during the threading process from piercing the FET insulating pads.



Drill the hole for T8 so that it is a snug fit and is deep enough to just take the whole transistor body. T8 is mounted under the board (take care of the pinout orientation) so that it slides into the heatsink hole when the PCB is mounted. This is done by inserting the leads of T8 through the underside of the PCB so that it hangs. Bend the leads a little so that it is retained. Using a few screws and 5mm spacers carefully place the PCB onto the heatsinks so that all the mounting holes line up. Make sure that the T8's body goes in the hole and then on the top side of the PCB bend T8's legs down fully. Lift the PCB off without any side movement then carefully solder one leg only of T8. Re-mount the PCB

and check T8's alignement. Once you are satisfied lift the PCB again and solder the remaining 2 legs.

Put a little thermal grease in T8's mounting hole, place insulating pads in position under the power FETs and permanently mount the board. Use the photograph as a guide. Tighten all the screws then using a multimeter check for shorts by measuring between the heatsink and the FETs drain (centre) lead. You should see an open circuit. If a short is measured lift the PCB and check for burrs or other damage to the pad.

Final Set up And Adjustment

No attempt should be made to set up or test a power amplifier module that is not correctly mounted on a heatsink. Make sure the main power supply is fused and the work area is clear. First check all your work and make sure the output devices are insulated from heatsink. The set up is done without an input or a load connected to the power amplifier.

- 1. Check the power supply is operating correctly and verify the rail voltages. Switch the power supply off and check with a multimeter that the rail capacitors have discharged.
- 2. Correctly connect the ground, positive and negative leads to the power amp module.
- 3. Remove the PCB fuses and replace with 100 ohm 5 watt resistors. Connect a multimeter that is set to the 20 volt scale across the positive rail 100 ohm resistor.
- 4. Check that the power supply connections are correct one last time and switch on. If the multimeter reading goes off-scale, turn off immediately and find the problem. Check also the 100 ohm 5 watt resistors; they may have gone open cct.
- 5. If everything seems ok adjust VR2 to set the output stage bias current, by measuring the voltage across the positive rail resistor. Adjust for a reading of 3 volts per output FET pair. I.e. For a 6 FET board set for a voltage of 9 volts. This equates to a bias current of 30mA per FET pair or 90 mA total. For a 10 FET board set for a voltage of 15 volts.
- 6. If everything seems ok, check the output offset voltage and adjust VR1 to achieve an offset of less than 10 mV.
- All being well switch off, back off the bias control trimmer (VR2) and replace the 100 ohm resistors with 10 ohm 1 watt resistors. Switch on again and re-adjust VR2 to get 0.3 volts per per FET pair across the positive rail 10 ohm resistor.
- 8. Switch off, remove the resistors and put the fuses back in. Switch on, re-check the offset voltage and adjust with VR1 if necessary.

The amp module is ready, connect the input and output and enjoy.