Construction Notes for the AV 800 watt MOSFET Power Amplifier

Introduction

The 800 Watt AV amplifier is based on My 1kw Amplifier and shares the same topology and basic PCB layout.
The only real difference is the number of Output devices that the unit uses.
The 1kw design has 20 O/P devices, while the AV amplifier has 14 O/P devices.
This amplifier can be used for practically any application that requires High power, low noise, distortion and excellent sound. Examples would be Sub-woofer amp, FOH stage amplifier, one channel of a very high-powered surround sound amplifier etc.
The AV amplifier has four main stages of amplification. We will begin by looking at each stage in reasonable detail.

The Error Amp Stage

The first stage is what I call an asymmetrical balance input error amplifier. It is a design, which allows only one single differential stage and yet has the ability to accept a balanced I/P source. An unbalanced source can be used if either the inverting or non-inverting I/P is tied to signal ground.

Now I will explain how each device in this stage works together.
Q6, Q7, R28- R29, and form the main differential error amplifier, which then has its collectors, connected to a cascode load. Q1, Q2, R13 and ZD1 form the cascode stage, which provides a constant 14.4 volts on the collectors of Q1, 2.
Q23, R42, R66, ZD2 and C19 form a constant current source, which supplies 1.5milliamps to the first differential stage. These modules form the first stage of the amplifier and basically set up how the whole amplifier is biased from front to back.

The Voltage Amplification Stage

This next stage provides most of the voltage amplification that the next stage needs to drive the o/p stage to full power.
Q3, Q4, Q24, Q25, R3, R54, R55, R40, C2, C9, C16 form the second differential voltage amplification stage. Q54 and Q55form what is known as a current mirror load for the second differential stage and basically force this stage to share the current supplied from R36, which is about 8milliamps.
The remaining components, namely the caps provide local frequency compensation for this stage.

The Bias and Buffer stage

As the name suggests Q5, Q8, Q26, R24, R25, R33, R34, R22, R44, C10 form the Bias and buffer stages. Its main purpose is to provide the MOSFET Gates with a stable and compensated supply voltage and Buffer the Voltage amp stage from the high Gate Source capacitance. Which would without this stage cause the frequency response and slew rate to be very poor indeed. The down side of this is the extra stage does introduce an extra dominant pole in to the amplifiers feedback loop.

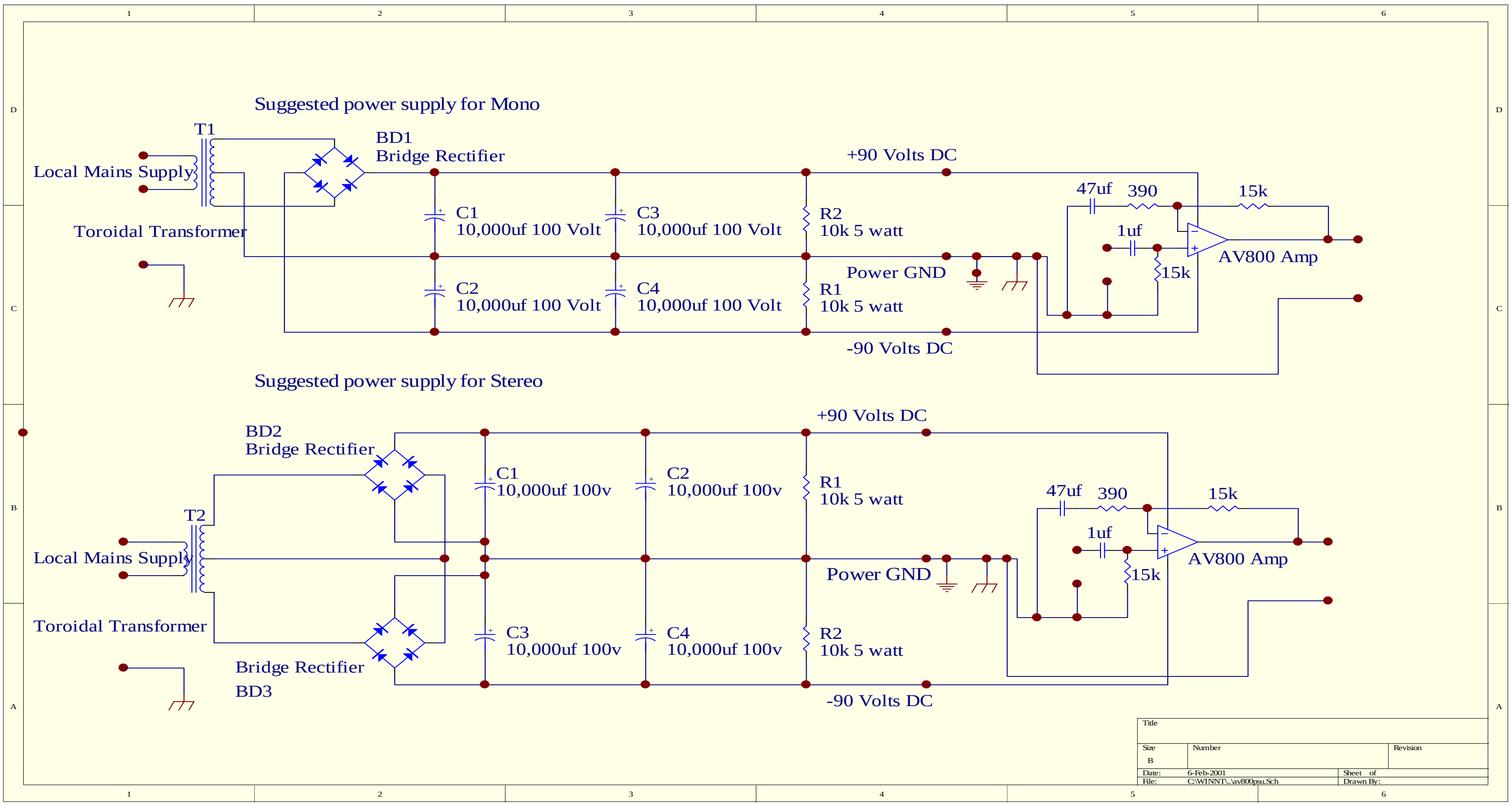
The Output Stage or Current Amplification Stage

Once again as the name suggests this stage converts the voltage developed in the VAS and provides all the amperes needed to drive 8 or 4-Ohm loads. 2-Ohm loads are possible for several minutes at a time. In fact I have tested the 1kw amplifier to over 1600 watts RMS into 2 Ohms. But this would not be recommended as a long-term load at all. As it does exceed the SOA figures of the output stage.

Power supply requirements for the 800 AV Amplifier

The power supply components for this amplifier are as follows and are expressed for One Channel or One power module only.
1 x Toroidal Transformer with a Core rating of 1KVA. Primary windings are made to suit your local mains supply. eg: for Australia One single primary winding with a 240VAC rating. For USA, 110VAC, 115VAC and I believe there is a 220-Volt AC mains supply in some areas of the United States. For the UK it would be 220 VAC to 240 VAC.
The secondary windings are as follows.
2 x 65 volts AC at full load.
One 400 Volt 35 Ampere, Bridge rectifier.
2 x 4.7K 5-Watt ceramic resistors
Minimum filter capacitor requirements would be 2 x 10,000uf 100 volt electrolytic.
Ideal capacity would be 40,000uf per voltage rail.

For stereo or dual mono operation the following power supply will be required.
1 x 2kva toroidal transformer with a core rating of 2kva
2 x 400 volt 35 amp bridge rectifier
4 x 10,000uf 100-volt electrolytic capacitors
2 x 4.7K 5-Watt ceramic resistors



Assembling the Printed Circuit Board

One of the first things to do is to look at the PCB and see if all of the holes on the board are of the correct size for the components you wish to insert. The holes that have been drilled into the PCB should be OK. However it does pay to check before you start. If you find that some of the holes are not big enough then you will need to drill them out to the correct size. The standard holes sizes used for most electronic components are as follows.

¼ watt ½ watt resistors = 0.7mm to 0.8mm

1–watt resistors = 1.0mm

¼ watt to 1-watt zener and normal power diodes = 0.8mm

Small signal transistors such as BC546 of the TO-92 pack = 0.6mm

Medium signal transistors such as MJE340 of the TO-220 pack = 1.0mm

Power Output devices such as the IRFP240 require a hole size of 2.5mm

However on this PCB these devices are mounted on the copper side of the PCB facing down flat.

The next thing that needs to be done is the cutting out of the PCB section, which has the output stage devices screen-printed on top of the PCB. This needs to be done so the mounting of the o/p devices can be properly clamped to the main heat sink. The best way of cutting this section out is to either use an electric router or drill 5mm holes in each corner and use a coping saw to remove the unwanted fibreglass and file the inside edges clean.

Start constructing the PCB by inserting any wire links, which are shown on the component overlays as R5, R23, R41, and R45. The wire links are made from spare component leads such as from 5-watt ceramic resistors or ¼ watt resistor leads.

Once the links have been taken care of the insertion of all the resistors is next, followed by the capacitors and then the small signal semiconductors. You will need to cross-reference the parts list with the white screen component overlay on the PCB to see where to insert the required component. Be careful to always insert the polarised components in the right way as shown on the screen-printed overlay. Failure to do this will most likely result in the module not functioning properly or damaging one or more of the components in the module.

The output stage transistors and Q8, which is the IRF610 device, are to be left till last.

The buffer stage transistors are to be mounted on 10 degrees/watt heats sinks with a one-inch pitch mounting.

The buffer stage devices do need to be insulating from the heat sinks, As they would be 180 volts across both of these heat sinks.