Updated 3/20/05

Here is the newest member of the CCS family. It was created by using the layout of the new battery biased CCS and replacing the batteries with the voltage reference from the Rev. 5 CCS.

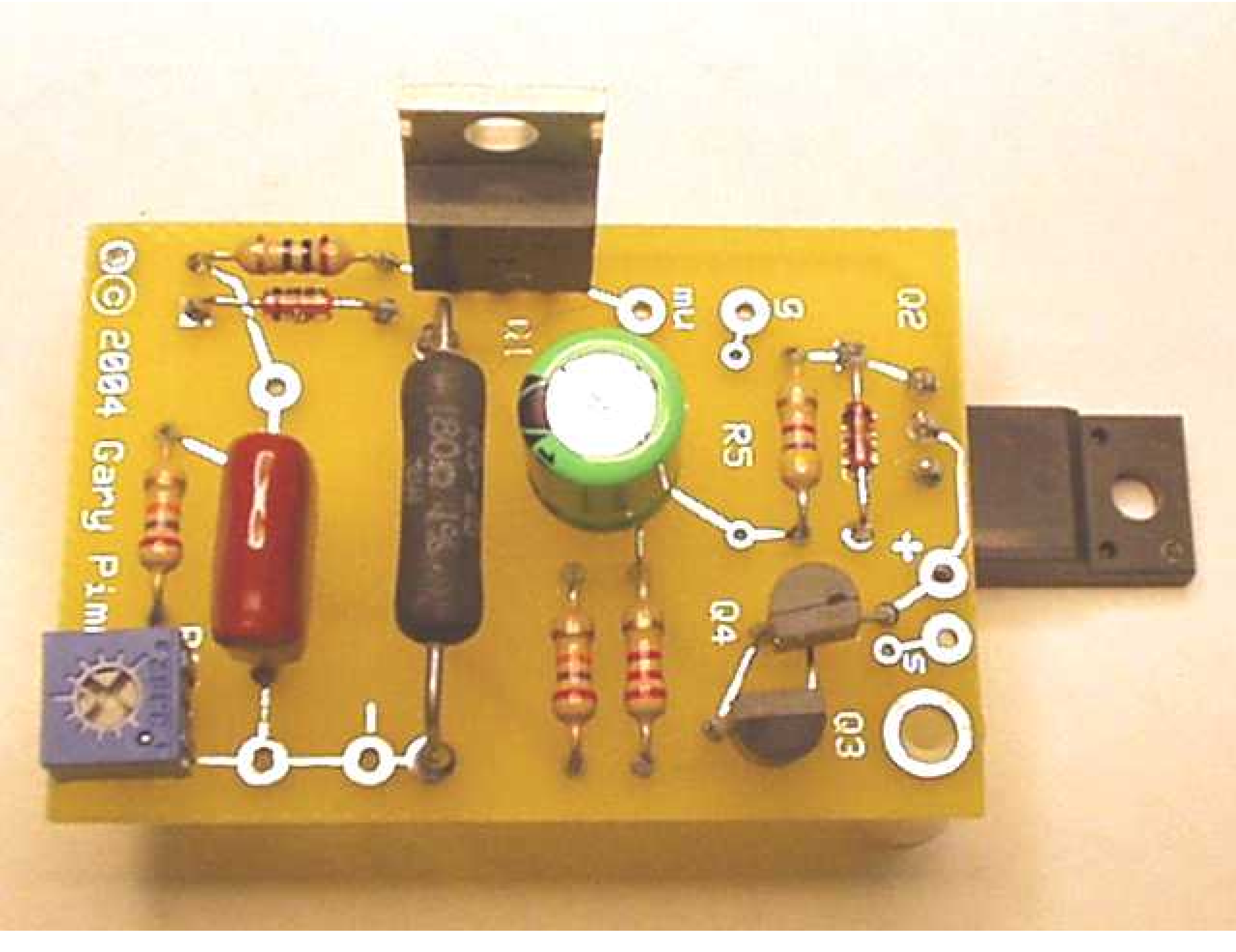
With the new voltage reference the self bias CCS starts softly. Initially, the current is only that of the reference, .35ma. As the voltage reference charges up C5 the CCS starts to conduct. It takes ~20 seconds to reach full output.

For choosing the value of R1 the voltage range of the reference is 9.5 to 27 volts. The turn on voltage of the mosfets is approximately 3.5 to 4 volts so the voltage range seen by R1 will be in the 5.5 to 23 volt range. Allowing for the variations in SS parts a working range of 8 to 20 volts should be available. The design center for R1 is 14 volts.

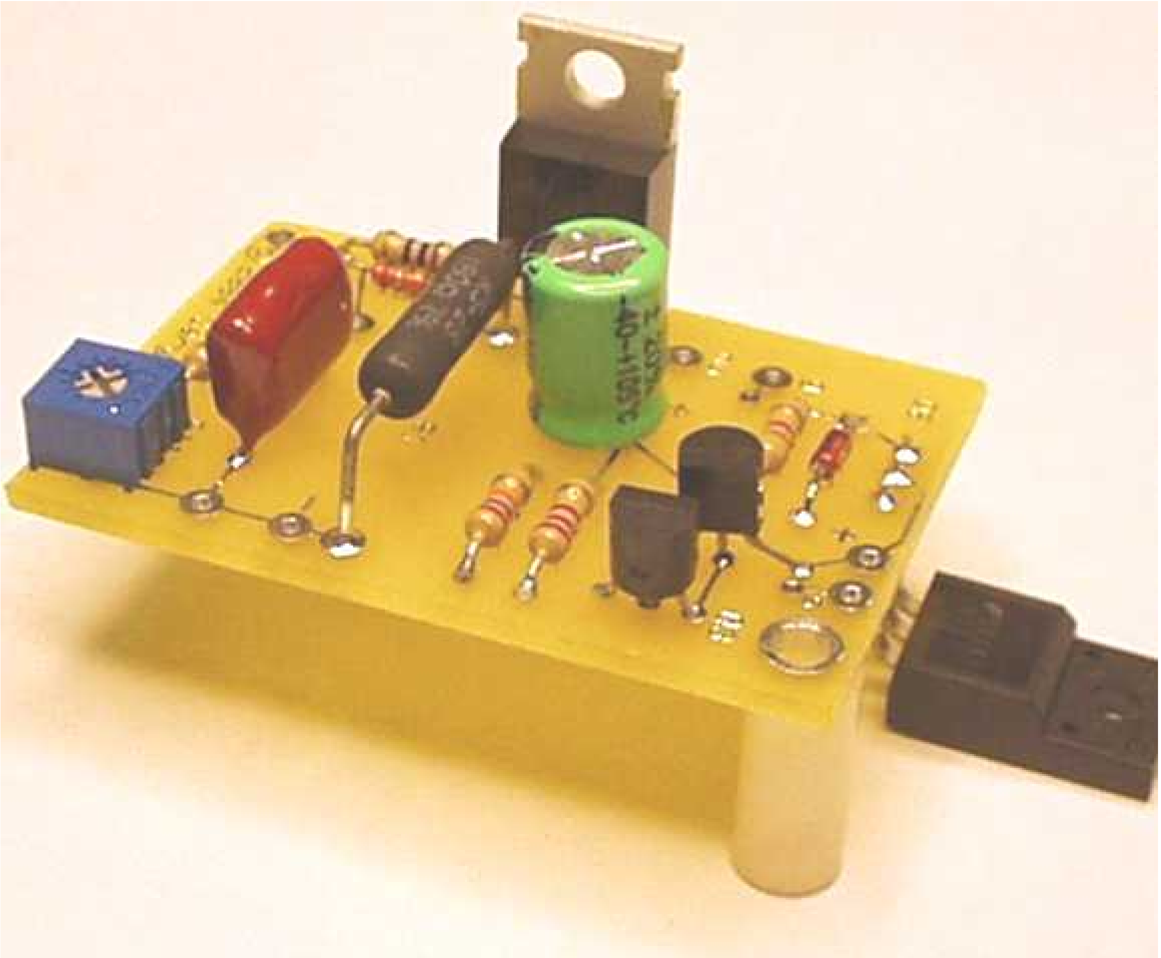
If you want to minimize the voltage requirements of the CCS R1 should be chosen to deliver the desired current at the low end of the adjustment range. R14 can be reduced from 27K to 15K to lower the minimum voltage required by the CCS by 4.2 volts.

The tradeoffs of these changes are minor but present. Lowering the value of R1 reduces the local voltage feedback reducing the effectiveness of the CCS slightly. In circuits where the CCS is use as a plate load for triodes reducing the value of R1 increases the noise gain can increase the noise floor in low level circuits. The noise gain is basically the plate resistance of the triode divided by the value of R1. Reducing the value of R14 could increase the shunt capacitance by a small amount as Q1 will have less voltage across it. Decreasing the voltage across MOSFETs below 10 volts quickly increases the capacitance.

Here is a self bias board setup for MOSFET only operation with Q2 on the back of the board to allow using the top plate as the heatsink. When operating the CCS's over ~90ma Q1 needs to have a heatsink also, either a small clip-on heatsink or Q1 can be mounted on the back side just like Q2 is shown here.

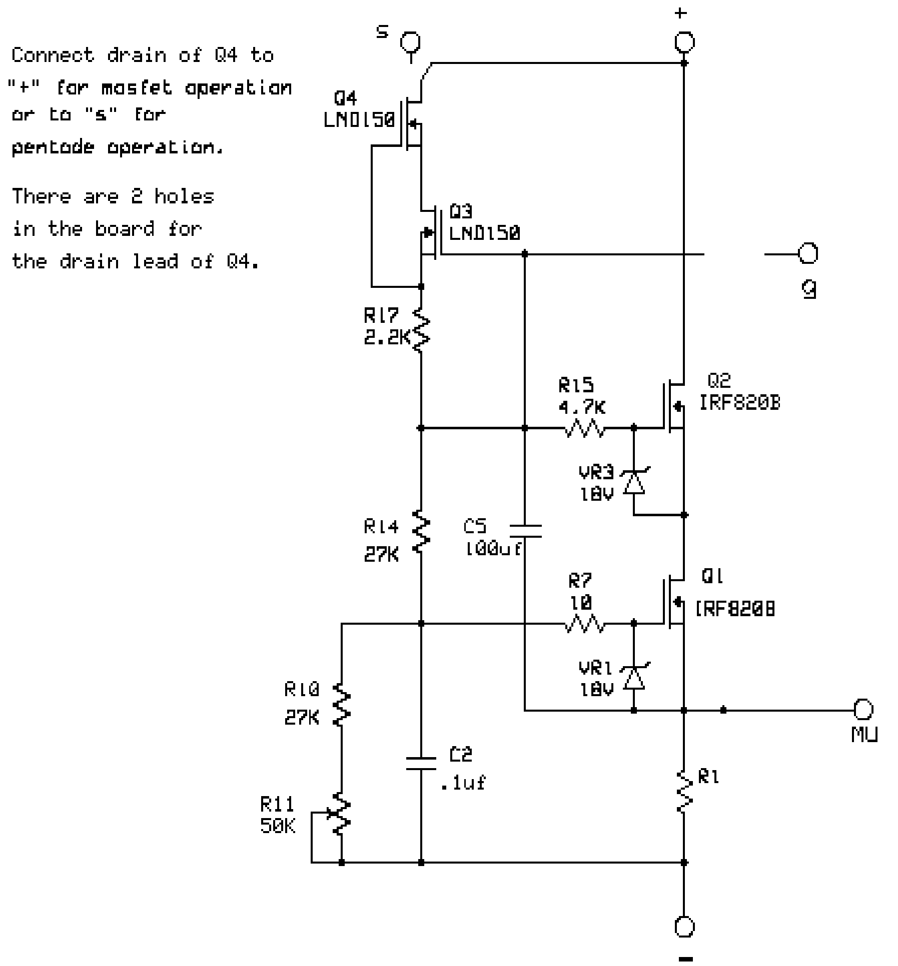


Another angle to help show how Q2 gets attached to the chassis



The standard TO220 package has enough lead length to allow for the use of either 10mm or 1/2 inch standoffs, depending on what standard is used in your country.

Here is the schematic of the self bias CCS.



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SIZE A	TITLE Self bias CCS	REV 2
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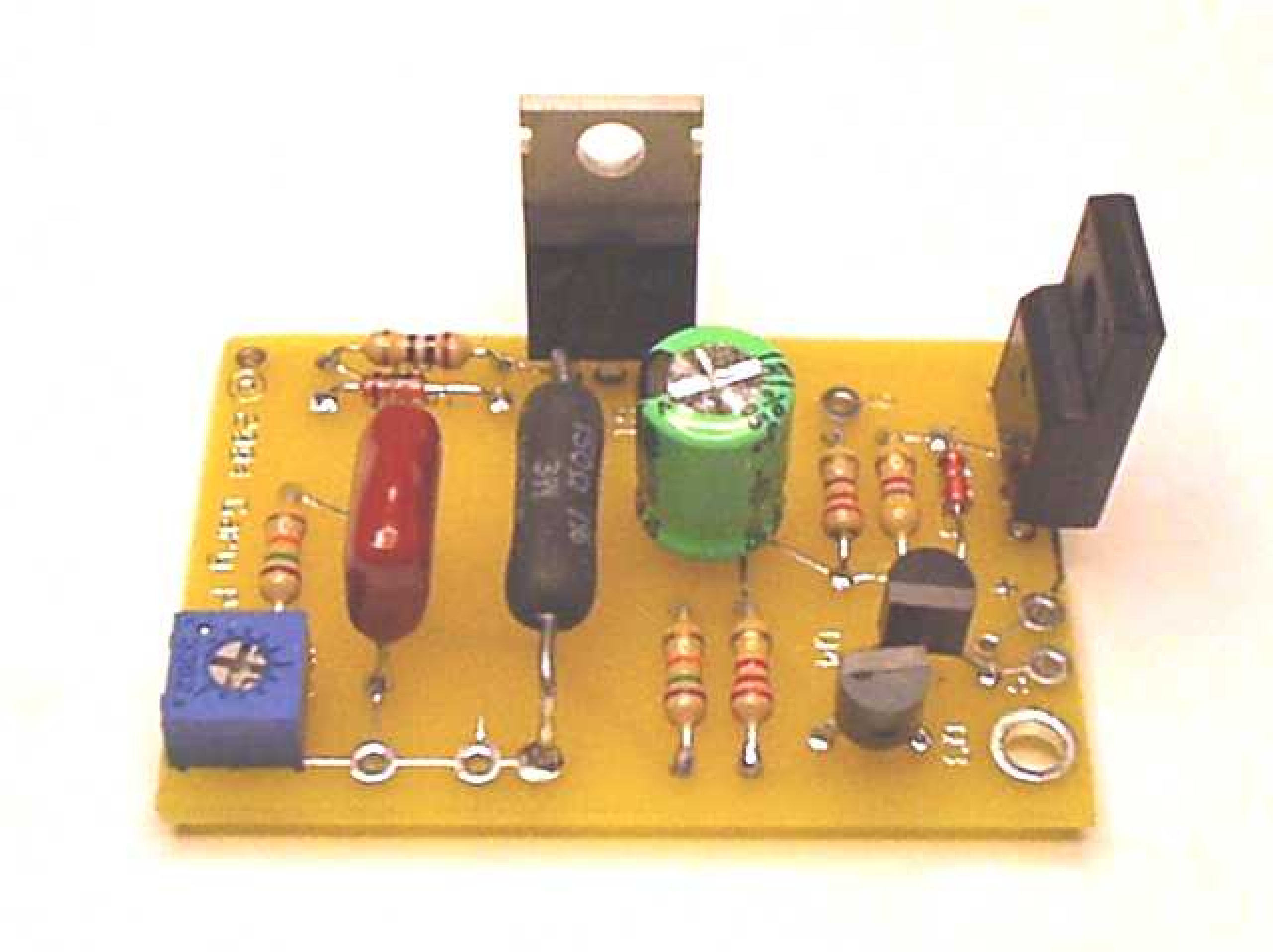
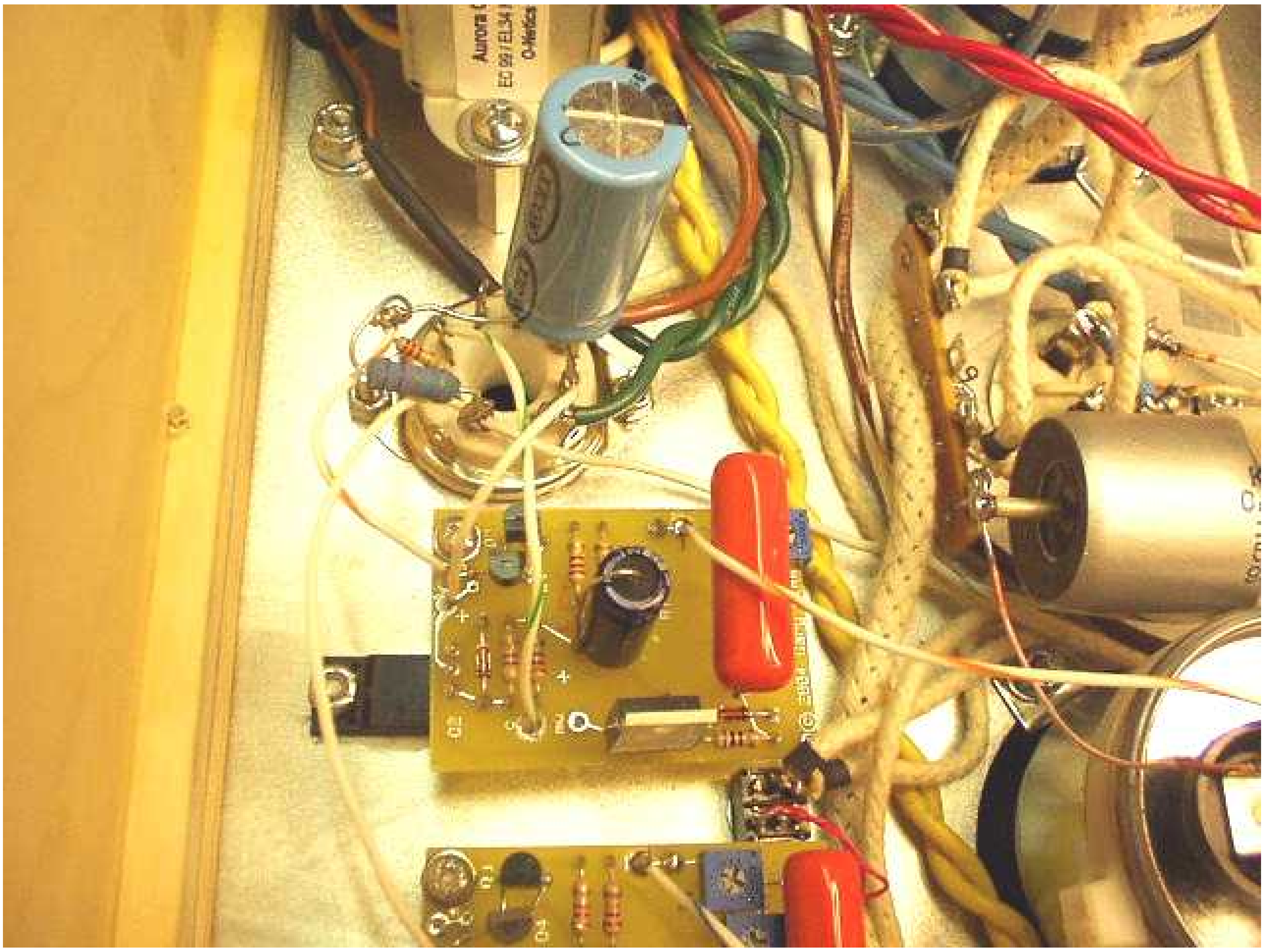
The self bias board supports the option of using a pentode for higher voltage/power/performance applications. This is basically the same circuit as the Rev. 5 with the pentode support parts mounted off the board.

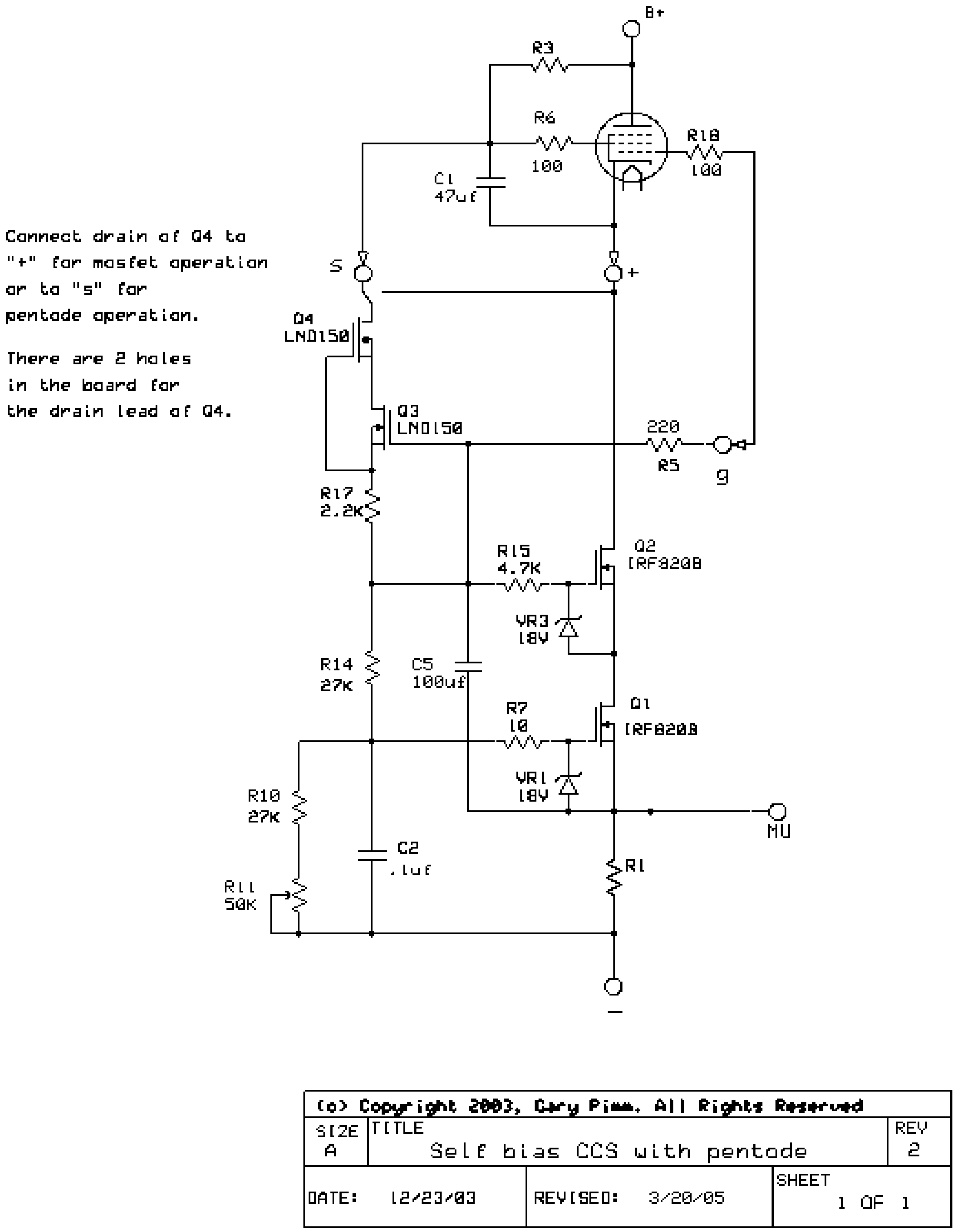
Here's an image of a self bias board setup for operation with a pentode in an Amity amplifier feeding the VR tube on the input stage. As it is setup for minimum voltage operation, note that R10 and R14 have been lowered to 15K each. With R3 having a value of 7.5K this will deliver 60ma with between 150 and 325 volts across the CCS. Changing R3 to 15K changes the operating range to 185 to 360 volts. The minimum voltages are the point where the grid bias of the pentode drops to -1 volt. The maximum voltages are where Q2 reaches 1 watt dissipation, the max for operation without a heat sink. Also note that the drain lead of Q4 is inserted into the board hole that is connected to the "S" terminal.



Here's an image of the input stage CCS setup using an EL34 pentode in Lynn's Karna amplifier. The CCS is used to feed the VR tube shunt regulator for the input stage.



Here is the schematic showing the board setup with a pentode



There are a couple of ways to choose the value of R3. In some of the earlier pentode versions there is a mathematical formula to try to calculate the value of R3. It's quite messy to use and you still have to guess at at least 1 of the parameters. Personally, I start with a value of 22K and see what happens. If the grid bias of the pentode is greater than 10 volts you can increase the value of R3. If the grid bias of the pentode is less than 2.5 volts you will want to decrease the value of R3. It usually only takes a few tries to get dialed in. The thing to watch is to make sure that the grid bias of the pentode does not drop below -1 volt at the lowest voltage the CCS will see in normal operation.