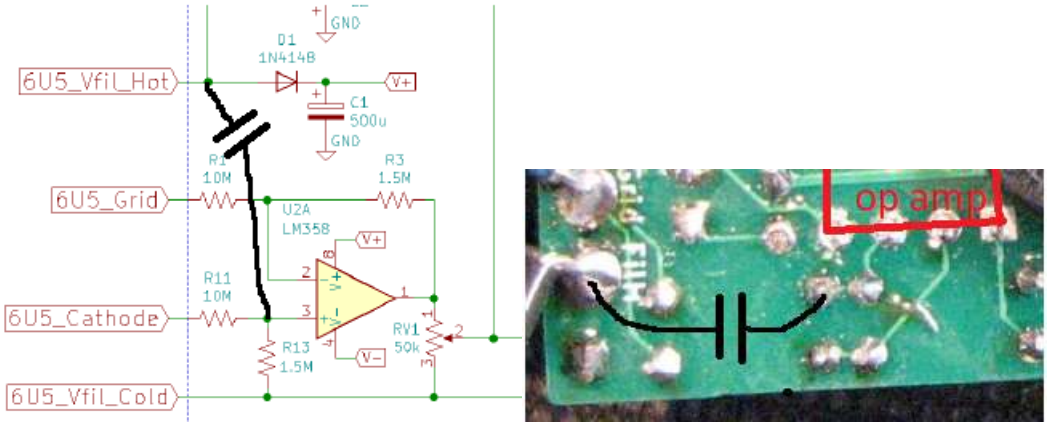
Dithering the 6E5/6T5

Gord Rabjohn, November 2023.

Several people commented that the project might benefit from dithering. Rather than having an abrupt switch when the input voltage reaches a threshold which causes the next segment to come on quickly, make the segment come on slowly. This could be done by ramping the threshold voltage (over time, back and forth) such that the segment comes on later for a lower input voltage (stays on for less time) or sooner for a higher input voltage (stays on for more time) .

This can be done easily on the solid-state eye tubes. One just needs to add a small AC voltage to the reference pin of the op amp. This AC voltage could come from the AC voltage generally used to energize the filaments of these tubes. At first, I thought I'd use a resistor, however the value needed proved to be quite large. I elected to use a small capacitor instead, and I think this does a better job. (Why? Keep in mind that the segments are only lit during the peaks of the AC waveform. So, the dithering will only matter at the peaks of the AC waveform, which is pretty flat. Using a resistor to couple AC into the op-amp would result in an almost flat "dither" curve, not much dithering at all, and certainly not linear. However, capacitor coupling is quite different. The capacitor will have most of the voltage across it at the peak of the waveform, so the rate of charging the capacitor will be maximum at the peak of the waveform, resulting in something looking more like a ramp at the reference pin.)

I connected a 20pF capacitor (value not too critical, but the larger the cap, the more dithering you'll observe) between FilH and pin 3 of the LM358. This made a visible difference to the smoothness. Too much capacitance, and the transitions just blur. I recommend that you experiment with values from 5pF to 50pF. This technique should work for both the 6E5/6U5 boards and the 6T5 boards, but since the 6T5 has fewer segments, somewhat more capacitance might be required.



This could theoretically introduce some hum into the host radio, but I don't think it will be a problem as the voltage is small and the radio will generally have decoupling on the connection to the grid of the tuning eye. You could add a 0.05uF capacitor from the grid lead to ground if it is objectionable.

I don't think that this will eliminate the need for a diffuser, but I do think that it will make the solid-state eye look a little less digital! Let me know how well it works.