Subject: 300B SE Project, Part 7 - Common cathode 6C45Pi triode driver
Posted by Damir on Sun, 26 Feb 2006 15:11:19 GMT
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6C45Pi – the «rumours» that it`s a triode capable of driving 300B, with impressive specifications, but not without «difficulties», are absolutely true, IME. Those tubes are relatively high µ, high gm, high current and high Pa «devices». Most of the time, they differ from specs and between each other – matching pairs are a must.What`s more, 6C45Pi has tendency to oscillations, and some measures are needed to prevent this. Not just that, but many DIY-ers reported «hard» and «unmusical» sound with this tube… is it worth the hassle? This triode has four cathode pins (connected together inside the tube) and two grid pins. I connected the resistor on each pin to act as a «stopper», in a manner showed in the picture 1:It`s a «noval» tube, and we can see that resistors are close to the socket pins.I tried two pairs of 6C45Pi in the circuit showed in Fig.2 – simple common cathode voltage amplifier, but with active load, cascoded DN2540N5 mosfets – known from «Guinevere» preamp project.Tube has very large anode load (CCS), and it «drives» high impedance load (grid choke), both much larger then internal anode resistance of our tube. Then resultant amplification is equal to the µ, or theoretical max. amplification factor, and distortion is low. I operated 6C45Pi tube with rel. low current (10mA) – I followed some published measurements and subjective tests / reccomendations to avoid «unfavorable» disposition of distortion artifacts (harmonics).The first pair has amplifications of 37/38 times, and the second «matched» pair 38,4 and 42 times. Anode voltage was more or less about 150V. This differs from the specs a little (Ua=170V, µ=50 in this OP).If our «average» amplification is about 38 times, and we have 300B «bias» Ugk=-73,5V (little more then –70V we discussed earlier, `cos of the new PT with larger voltage), and our tube needs max. 73,5/1,4142 = 52Vrms for max. power in class A1 – then input voltage for 52Vrms output from the driver is 52/38 = 1,37Vrms. If we have 2Vrms input source (CD player), then we must attenuate the input about 3,3dB, or in other words – we have some gain «reserve» or headroom, (maybe) needed for «quiet» CDs/sources.Input «grid leak» resistor must be under 150k (according to the specs), preferably much less, and I chose 47 kOhms. The problem with this (common cathode) arrangement is large input (Miller) capacitance. If we use a volume pot at the input, it is prefferable to have rel. small value, say 10k if possible. Output impedance of the pot (Rpot/4 max. – in the center position) with input capacitance forms a low-pass filter.The sound – little on the «hard» side, dark, lot of «punch» and dinamics, «enhanced» bass - the notes have more «weight» then 6J5GT driver (next «chapter»). But, it somehow lacks «refinement» and details – 6J5GT gives more transparency and naturalness in vocals.Good sounding choice for some music, but for the more «delicate» things it somehow has the «rough» and «agressive» and inssufficiently «detailed» sound. But, it`s about nuances, not large differences.DN2540N5 CCS has the advantage for having two outputs, besides «normal» anode out, it has low impedance «Mu-out». Anode out is a little «softer» and «rounder» sounding, maybe a little more natural, and Mu-out has a bit more highs and a «punch». I switched back and forth between them and in the end I used Mu-out, showed on the schematic. Personal preference, and easy to try both. But, 6C45Pi has low anode impedance (even with unbypassed Rk) and the difference isn`t large.But, I have the problem with mosfet CCS/circuit – «dry» and «shhh» sound on some instruments (vocals) probably meant a bit of oscillations on RF. I increased gate stoppers a little (to 1k2) and added «output» resistor of 47 Ohm. This, and shorter wires «tamed» this to unaudible.Grid stoppers on 6C45Pi are necessary (enlarge them if needed), maybe even two

100nF caps from pins 4,5 (heater) to ground, direct on the socket (I didn`t use them).And one more thing – we have almost 300V voltage «drop» through the CCS, and with 10mA current, dissipation is about 3W, mostly in Q1. I used «ribbed» heatsink for Q1, 32x20x37mm and it becomes warm after some time, but not too much – you can still touch it safely. Smaller heatsinks are not reccomended, and transistors with less then 400V «working» voltage, too. PCB for DN2540N5 CCS is here:http://audioroundtable.com/GroupBuild/messages/1079.htmlCurrent setting is here:http://audioroundtable.com/Tubes/messages/929.htmlI tried resistive load, too (Fig. 3) – I simply substituted CCS with 27k/5W (minimum) resistor, OP is very similar, (Ia=10,5mA, Ua=150V) and amplification is a bit less - 34,9 times. Anode resistor of 27k and anode resistance of about 1,6 kOhms formed voltage divider and lowered the amplification a bit. This time we must bypass the Rk with (quality) electrolytic capacitor.The sound is similar as with CCS, a little more «thicker» and «warmer». Switching back to the CCS is a «revelation» - IMO, resistive load is «scaled down» sounding version. CONCLUSION: With some little measures 6C45Pi works very stable and quiet, amplification is about «right» 38 times (based on 4 samples). Sound is a little on the «agressive» side, but IMO – «good enough» to be usable as a 300B driver.Although resistive load gives solid performance/sound, my opinion is that CCS load is better...