Parallel High Voltage Regulator

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The article considers two variants of a parallel voltage stabilizer with a regulating element based on a vacuum triode and MOSFET transistor

The use of classical parallel stabilizers is very limited, first of all, this is due to a significantly lower efficiency compared to series circuits. But they have a couple of features that, with minor and little me
load currents make them very attractive for use in audio devices, especially those with a significant gain.

First, they are natural filters on the input side. The ballast resistor together with the output capacitance of the stabilizer form an RC filter operating in a wide frequency band.

Secondly, such a stabilizer consumes almost direct current. This ensures good isolation between the channels when they are powered by a single rectifier. This is very beneficial, for example, in RIAA equalizers or multichannel microphone amplifiers.

And, as a bonus for inexperienced hobbyists, such circuits are not afraid of short-term short circuits and output overloads. Since the current in the load circuit is also limited by the ballast resistor, errors and malfunctions in the powered circuit also do not lead to fatal consequences.

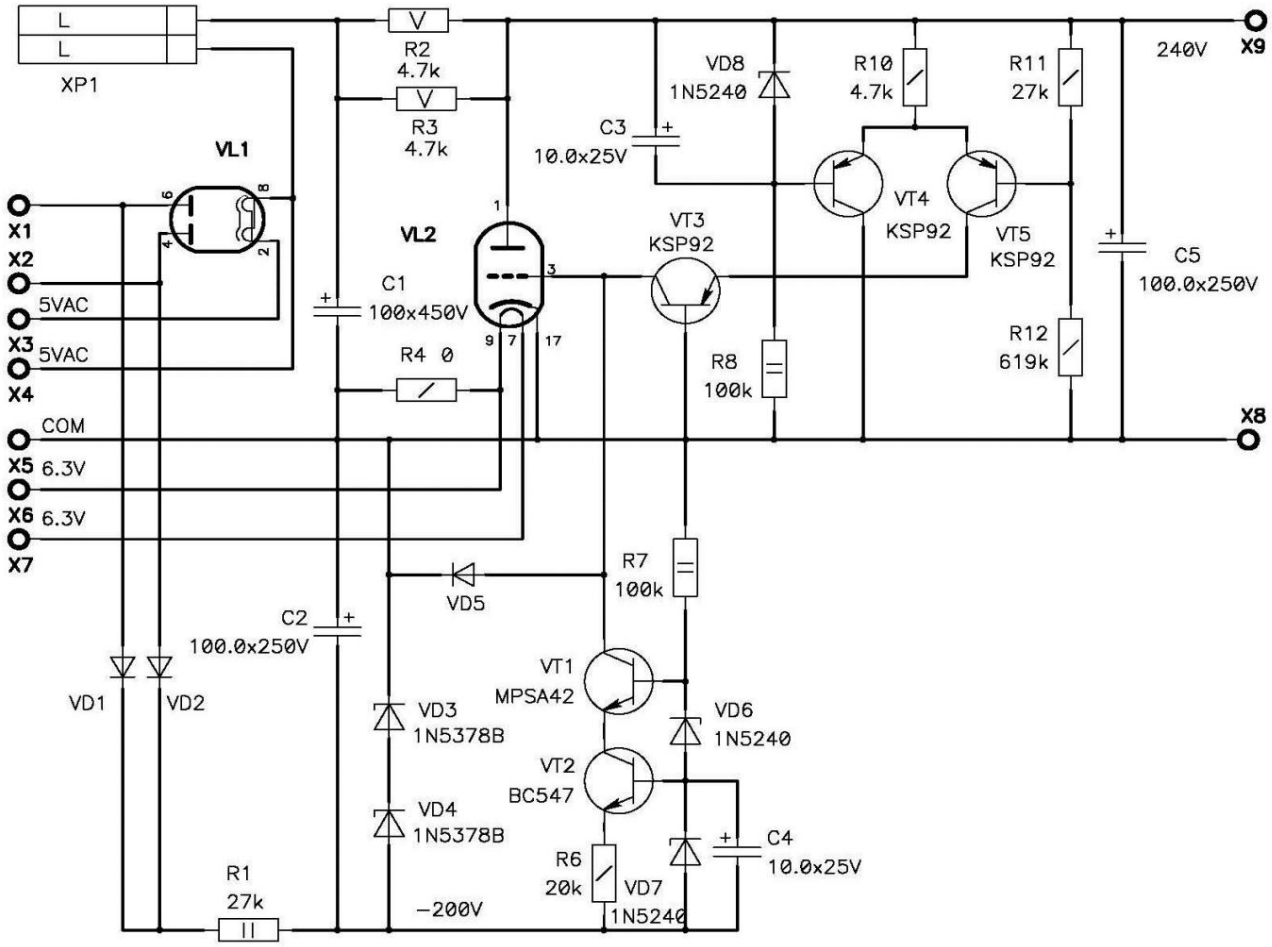
And a few words why a lamp is used as a regulating element. The main reason is the desire to get rid of the transistor cooler. Often, a rather bulky cooler of standard geometry does not fit well into the design of a lamp device. You can also add such an existential reason as the purity of the lamp
rows.
In principle, there are no contraindications to use not a lamp, but a MOSFET. And the technical parameters of the stabilizer will be better due to the higher transconductance of the transistor. But you will have to tinker with the placement of the cooler so that you do not get a cow under the saddle. A variant of such a scheme will be given in the article.

The stabilizer circuit is shown in Figure 1. I want to immediately draw your attention to the fact that if the control element is a lamp, then the rectifier must be on the kenotron (with indirect heating), or additional measures must be taken to limit the voltage at the input of the stabilizer before the control lamp warms up (delay in supply anode voltage, for example).

The rated output voltage of the stabilizer is 240 volts.
Rated output current - 20 milliamps.
Stabilization coefficient - ~750
Ripple suppression at 100Hz - 60dB
Input voltage range - 300÷370 volts

The magnitude of the output current and the allowable input voltage are interdependent and are related to the maximum power dissipation on the lamp. These data are given when using a 6S19P lamp, the use of more powerful lamps (6N13S, 6N5S, 6S41S) and adjusting the value of the ballast resistor (R2, R3) allows you to change these parameters over a wide range (changing the value of the ballast resistor will change other parameters of the stabilizer).

A convenient and economical solution would be to use one double triode for each channel's separate regulators.



Picture 1

The stabilizer circuit does not have any features and tricks, and is almost classical. On transistors VT4, VT5, a differential comparison circuit is implemented, the stabilizing ron VD8 works as a reference voltage source. The peculiarity of the scheme is that cascode switching is used in one arm (VT3, VT5). In addition to the fact that this improves the frequency properties of the UPT, it also allows the use of non-deficient transistors with an allowable voltage of 300 volts. The cascode stage is loaded on the current source (VT1, VT2), which provides a sufficiently high loop gain.
The current source is fed with a negative stabilized voltage from an auxiliary rectifier (VD1, VD2) fed from the main winding of the transformer.

The long-term stability of the output voltage is mainly determined by the reference voltage source and the divider R9, R10. If a zener diode and non-precision resistors in the divider are used as a support, then the output voltage drift can reach 1÷2%. In most cases, this does not play a significant role.
Although the stabilizer is not prone to self-excitation, but the installation features and variations in the parameters of the components can lead to generation. To “calm down” the stabilizer, a small corrective capacitance (100÷200 pF) is included between the collector and the base of the VT5 transistor.

A variant of a stabilizer with a regulating transistor is shown in Figure 2. It has similar parameters, but the circuit is a little simpler. The stabilizer can also be powered by any type of solid state rectifier, but care must be taken to obtain an auxiliary negative voltage to power the current source. If a "null" scheme is used

main rectifier, then a negative voltage can be obtained in a manner similar to that used in the lamp version.

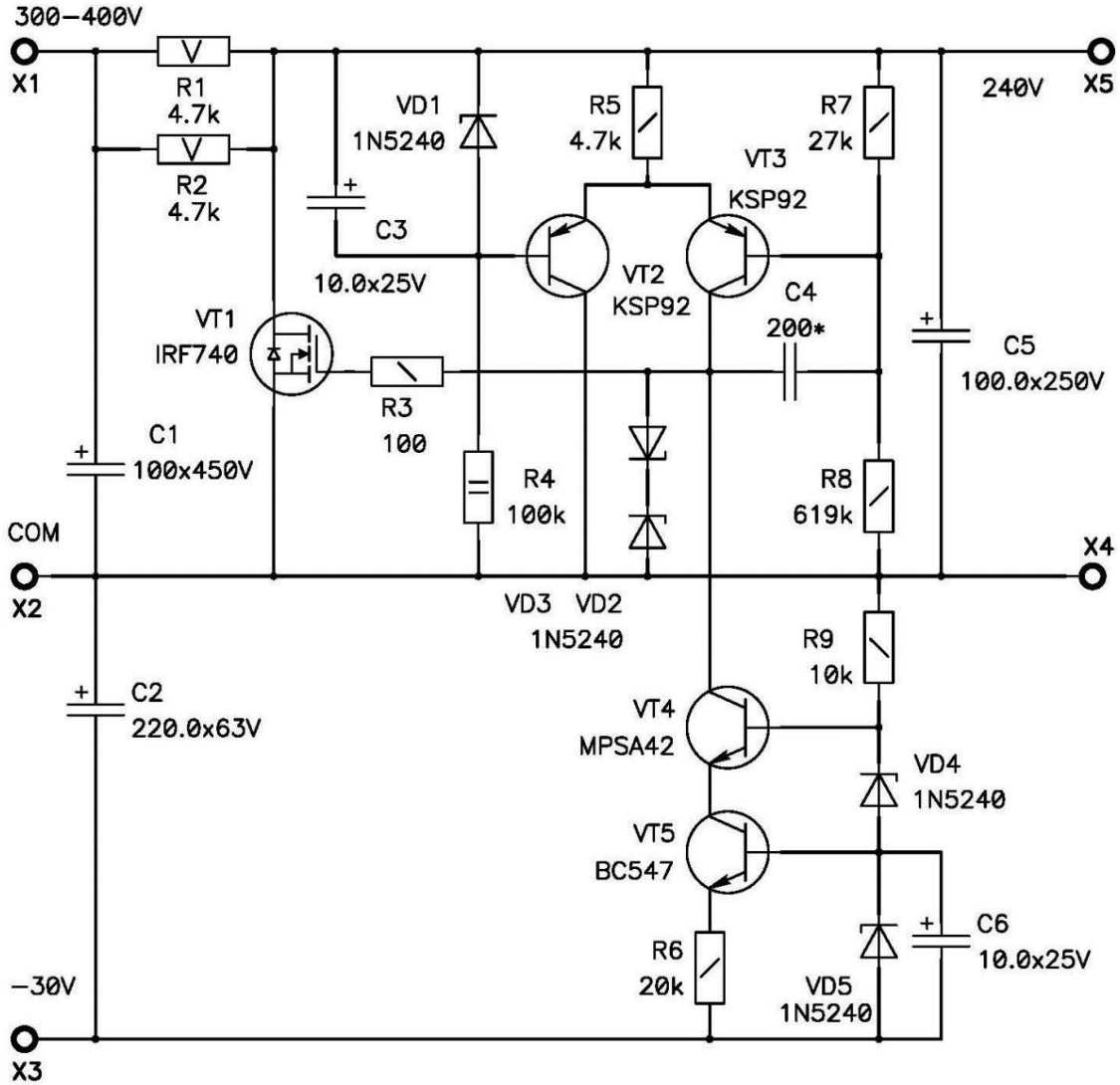


Figure 2

A few notes that are common to both circuits: It is desirable to provide thermal contact between the transistors of the differential stage. It is undesirable to use any tuning resistors in the output voltage divider circuits. If the stabilizer is implemented on a printed circuit board, then provide space for an additional resistor connected in parallel with R11 (R7), taking their value more than necessary. If non-precision resistors are used, it is advisable to select them before installation. In the second version of the schema
resistor R3 must be located directly near the gate of the transistor.

Adjustment stabilizers do not require, it is only necessary to check (adjust) the output voltage and check the absence of self-excitation.

There are no special requirements for the configuration: the elements must be in good condition and comply with the parameters declared by the manufacturer. Only one should pay attention to the quality of the output capacitance; if desired, it can be shunted with a film capacitance of several microfarads.