DRIVER WITH IMPROVED PARAMETERS

Evgeny Karpov

The driver scheme with improved parameters is presented ramie for the output stage of a single-ended amplifier.

This article is mainly designed for intermediate-skilled radio amateurs and has a practical bias. The driver circuit uses proven and well-proven solutions, there are no complex winding units, all the necessary information is provided for repetition

devices. The

driver turned out to be quite universal in application, a large amplitude of the output
voltage and a large quiescent current of the output stage make it possible to excite most powerful output lamps, put them into a mode with grid currents, and work with a significant capacitive load. At the stage of prototyping, the driver was also tested in an emergency mode - as a preliminary
amplifier. To reduce the transmission coefficient, the first tube was replaced by a triode with a smaller
μ value (6ÿ8ÿ). The result has been very positive.

All measurements were carried out under some average conditions of real operation: signal source resistance - 600Ohm, load resistance - 100kOhm, load capacitance - 200pF, output voltage - 40Vrms.

The driver has the following options; Gain

Maximum output voltage swing	thirty
Harmonic ratio	110V
Output impedance	0.36%
Input impedance	~600 Ohm
Input capacitance	470 kÿ
Frequency response flatness (20Hz÷500kHz)	30pF -3dB
Output voltage slew rate	30 V/μS
Edge asymmetry	<5%

The following can be added to this list. The harmonic coefficient is practically independent
on the frequency of the input signal, and only the second and third harmonics are present in the distortion spectrum
(Fig. 1). The driver is characterized by a rapid decrease in the level of distortion with a decrease in the amplitude of the output signal
(Fig. 2), the limitation occurs smoothly and is accompanied by an increase in the level, in
first of all, even harmonics.

The drop in the frequency response in the low-frequency region is deliberately implemented. Made it
to reduce the overload of the output transformer by infra-low frequencies and the normal operation of the tracking system for stabilizing the high-power lamp mode. In principle, no special technical
there are no restrictions for extending the range to the low-frequency region. An increase in capacitances C3, C8 makes it possible to shift the frequency range up to units of Hertz.

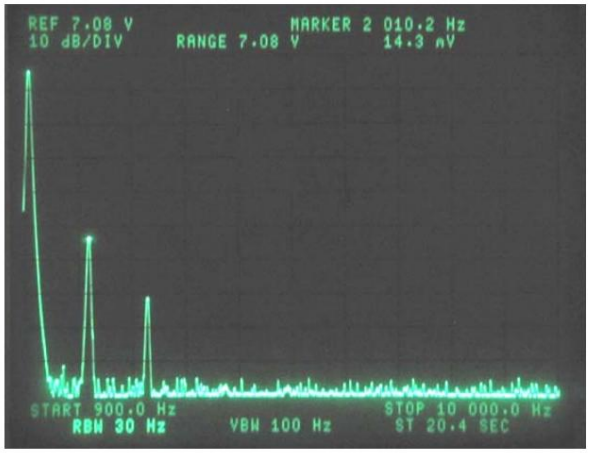

Figure 1

(the first harmonic is partially suppressed)

Perhaps the most significant drawback of the circuit is the high supply voltage. But not here
There was another way out, the requirement for a large output voltage range on the one hand, and the use of a lamp current source in the output stage determined the required value of the anode voltage. In a sense, it was an experiment to replace a solid state current source
to lamp. I will say right away that at first glance I did not notice any particular advantage in sound, here a longer period of analysis is needed, and in conjunction with a specific output stage. But the fact that it's more audiophile - exactly ÿ.

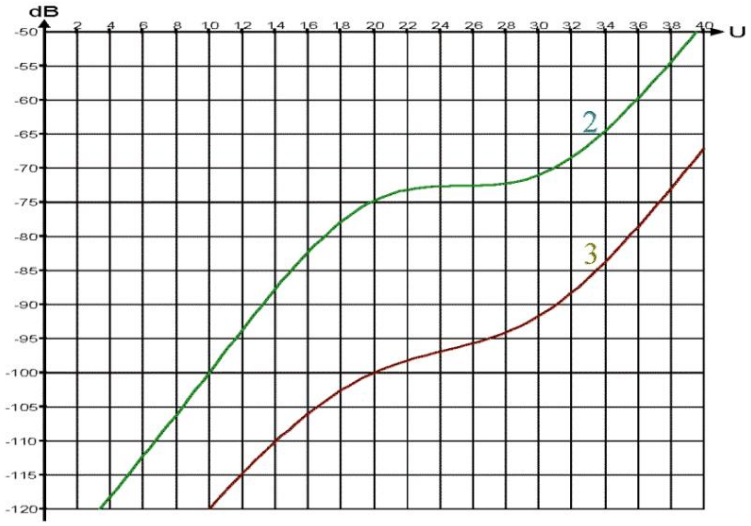

Figure 2

Driver circuit

The complete circuit diagram of the driver is shown in Figure 3. The circuit design is close to classical, but without the purist bias. The input stage is based on a double triode in a cathode coupled scheme with dynamic power supply. The operation of such a cascade has already been repeatedly described in previous articles, so we will not dwell on it especially. Input (VL1) stage lamps
operate with a high anode current, which provides good noise characteristics of the cascade and broadband. The only thing I want to say again is that in terms of the possibility of getting a big
output voltage swing with a wide frequency band with a stable and small input capacitance and excellent sound qualities - no alternative has yet been found for it. Works well in cascade
lamps with a wide opening of anode characteristics. Instead of a 6N1P lamp, you can use 6N23P and 6DJ8 without changing modes.

The connection between the amplifying stage and the output cathode follower is direct.
The repeater itself has some features. The current source in the cathode of the follower is made on powerful pentode (VL2) and is controllable. Through capacitance C6, an inverted input signal is supplied to the control grid of the pentode. When the feedback signal is re-inverted by the lamp
VL2 - a local positive (formally) feedback is formed. The depth of this local OS
less than unity over a wide bandwidth, so the output follower is not prone to excitation
even when operating on a significant capacitive load. In fact, at high frequencies, the output follower becomes push-pull. This partially compensates for losses in the cathode follower.
and significantly improves both the transmission of steep edges and negative polarity pulsed signals.

Another feature of the repeater is the use of a repeater lamp to power the filament.
VL3 additional transformer located directly next to the lamp. Withdrawal
restrictions on the allowable voltage between the cathode and the heater significantly expands
list of suitable lamp types.

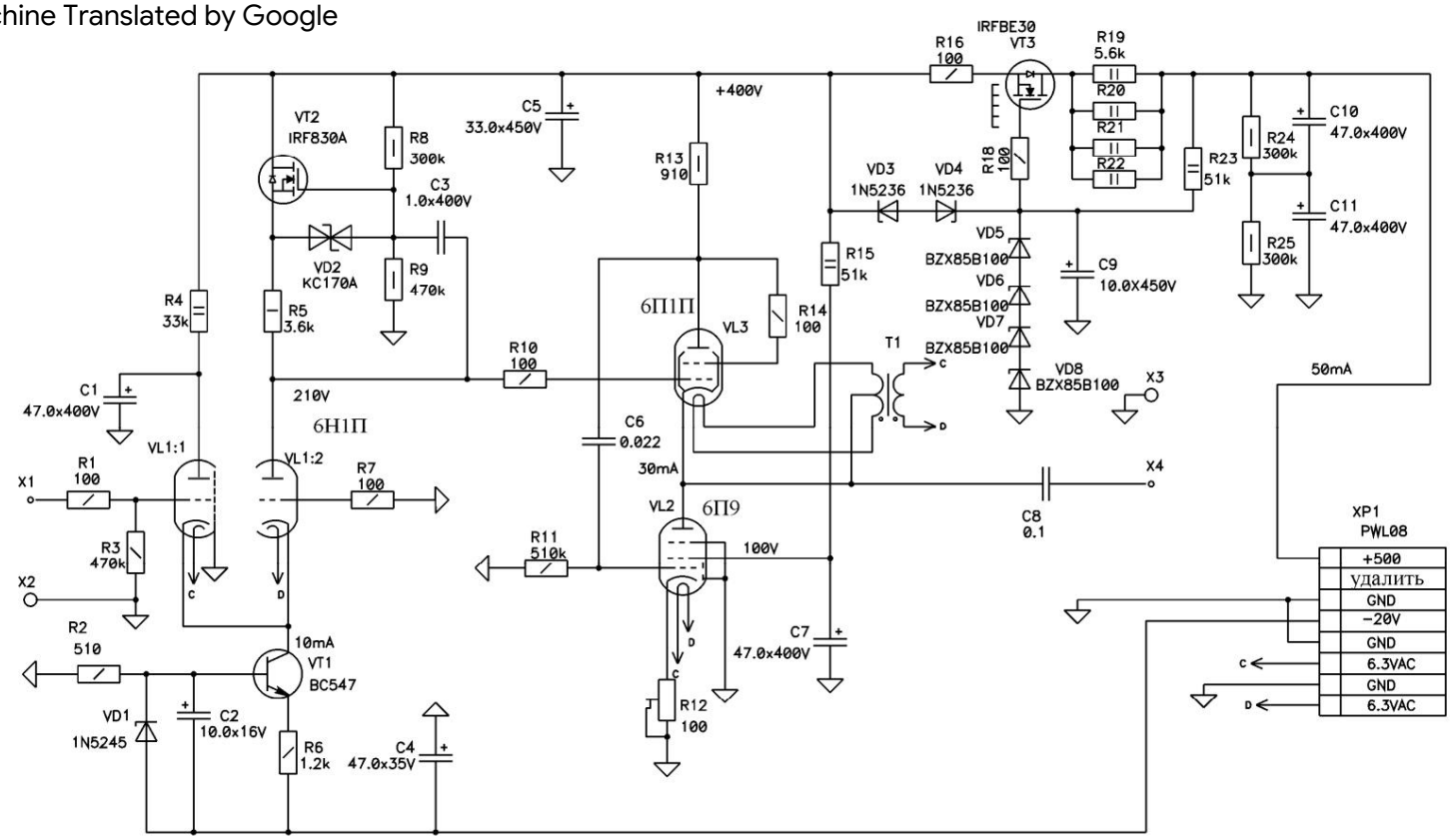

Figure 3

The local filament transformer has a conventional design, but heavily thickened insulation between the primary and secondary windings. This reduces the through capacitance between the primary and secondary side (on the order of 50pF). This allows you to connect the midpoint of the filament winding to the cathode lamp and minimize the background level with a slight increase in the capacitive load on the output repeater. It is

better to use a VL2 lamp of this particular type, but instead of VL3 you can use 6P14P and the like (which will slightly improve the driver parameters), 6E5P, you can try 6N6P with a slight decrease in quiescent current.

A simple high-voltage regulator is integrated directly onto the driver board. it not only ensures the stable operation of the driver when the supply voltage fluctuates, and improves driver parameters in the low-frequency region, but also reduces the interference of channels when feeding them from one source. The driver works when the input high voltage fluctuates within 450÷570 volts. The input high voltage must be well filtered. negative voltage (-20V) must be stabilized and have a low level of ripple.

Construction and adjustment

Structurally, the driver is assembled on one printed circuit board (Fig. 4, Fig. 5, Fig. 6). Signal pro Water connections are connected by soldering, and power is connected through a connector, which is optional. Some there are no special requirements for details, use resistors with the specified power dissipation, so the power of the resistors is chosen not only based on the actual power dissipation, but also on the allowable operating voltage. Particular attention should be paid to the capacitance C8 (a capacitor was used type MMKR Vishay) and resistor R12. The resistor must have stable parameters and be multi-turn; resistors of the SP2-x type are best suited here. The transformer is wound on the core ÿÿ12ÿ25. The winding is ordinary, the primary winding contains 100 turns of PEV-2 0.57 wire, and the secondary winding contains 2x57 turns of the same wire. winding secondary winding lead into two wires, the half-windings are connected to obtain a midpoint. Interlayer insulation - PTE film 0.1mm thick, interwinding - about 1mm from electric cardboard.

Figure 4

In principle, any other core with approximately
similar dimensions (in particular, from "wall" adapters). Naturally, the number of turns will have to recalculate taking into account its active cross-sectional area. You will also need to adjust the number of turns secondary winding when using other lamps with a very different filament current (take into account the voltage drop on the windings). The transformer is attached to the board with a steel bracket.

Transistor VT2 is installed on a radiator with an area of a couple of square centimeters, and for transistor VT3 you need a radiator with an area of at least 60÷70 cm2 .

The board is set up in the following order:

Voltage -20V is applied to the board with uninstalled lamps by closing the collector through the multimeter VT1 to a common wire, check the current of the current source. It should be within 8÷11mA, if necessary, adjust its value with resistor R6.

A high voltage is applied to the power input and the output voltage of the stabilizer is controlled, the allowable values are 390÷410V. With significant deviations, the type of one of the zener diodes VD5÷VD8 is changed.

Insert the VL1 lamp, apply all supply voltages and check the voltage at the VT2 gate. It
must be within 230÷245V (the voltmeter must have a high-resistance input). If necessary, select the resistor R9. Check the voltage at the anodes VL1, if they differ more
than 10÷15V between themselves, use a different lamp.

Insert lamps VL2, VL3, supply all supply voltages. Check for the presence of voltage
and its value on the lamp VL3. The quiescent current of the output stage is set to 30 ± 3mA by the resistor R12 (it is controlled by the voltage drop across the resistor R13). If the quiescent current could not be set (too small), reduce the value of the resistor R15 by 15% and repeat the process of setting the quiescent current.

If appropriate equipment is available, check the frequency response, distortion level, gain, maximum output voltage swing. Basically, the scheme is
good repeatability, and this item can be excluded.

This completes the driver setup.

For a stereo amplifier, it is desirable to pick up paired VL1, VL3 lamps in the channels.

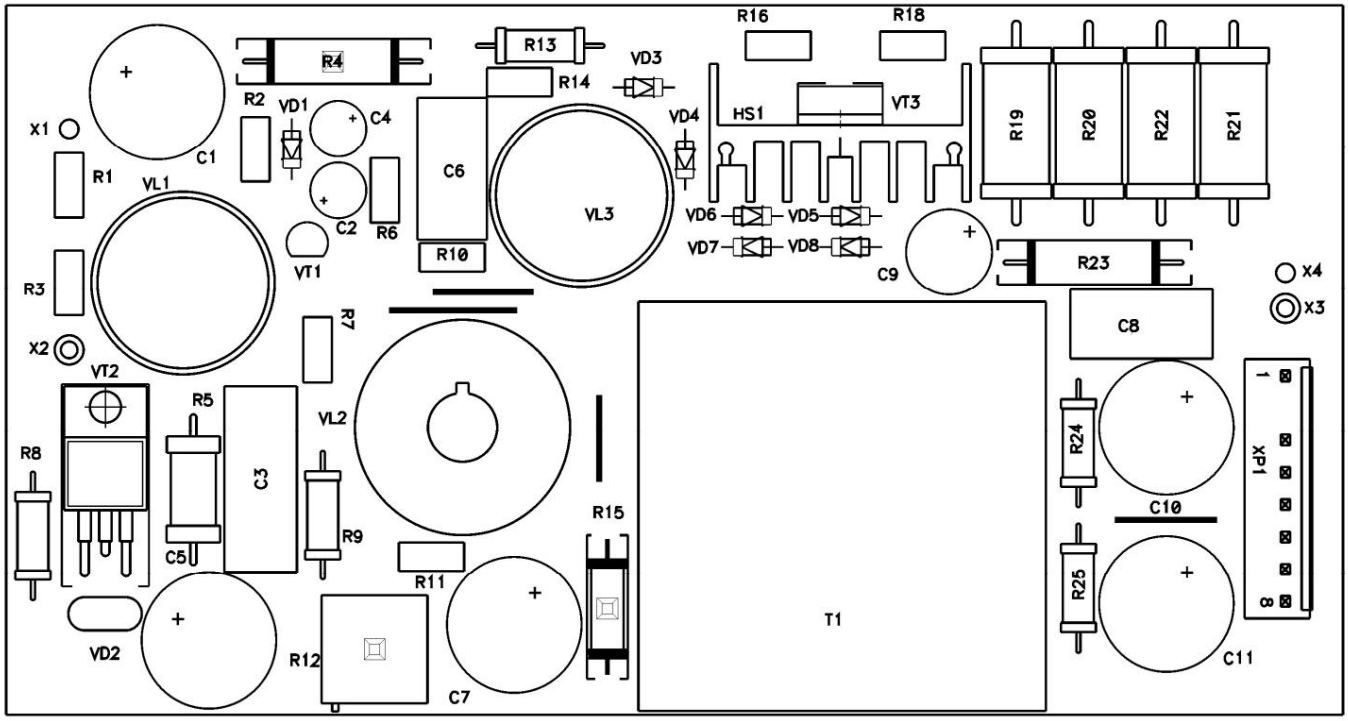

Figure 5

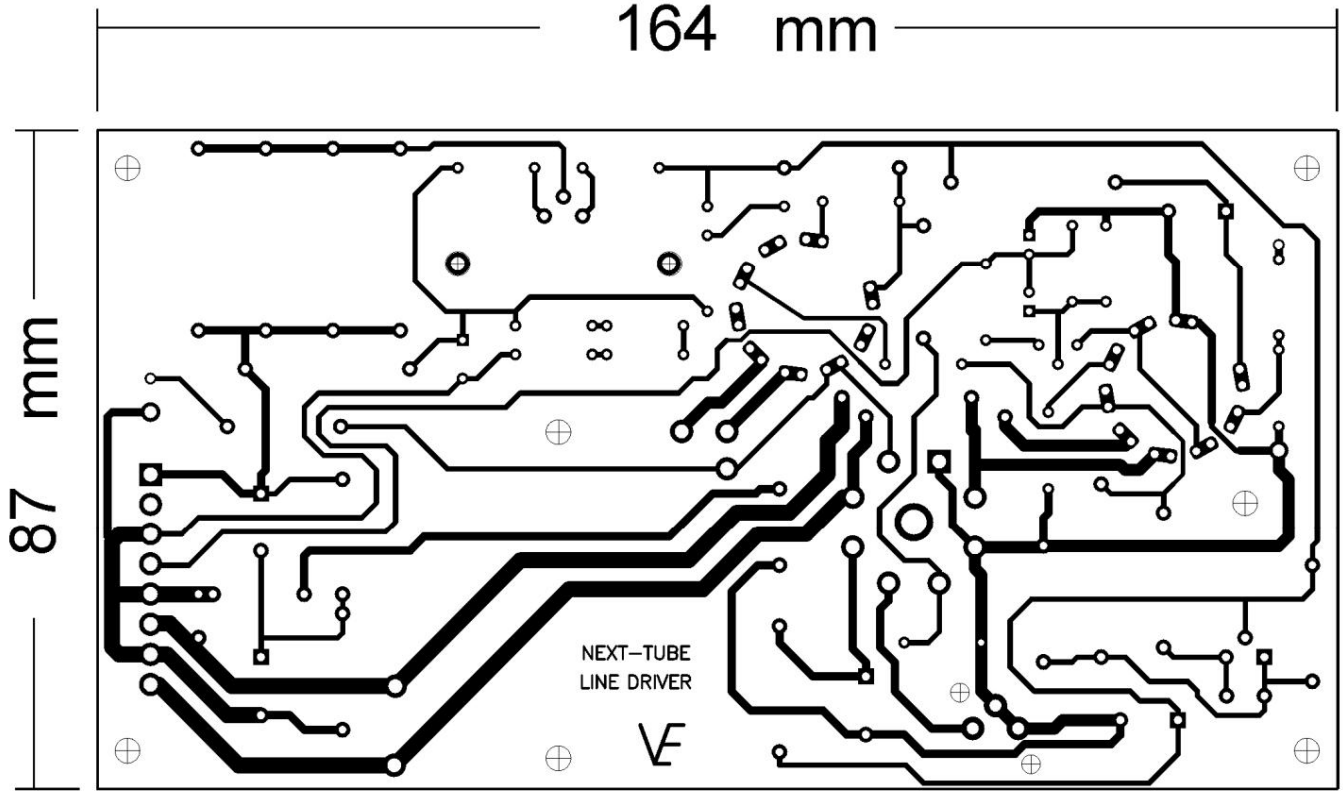

Figure 6 (Mirror)

