High voltage laboratory stabilizer

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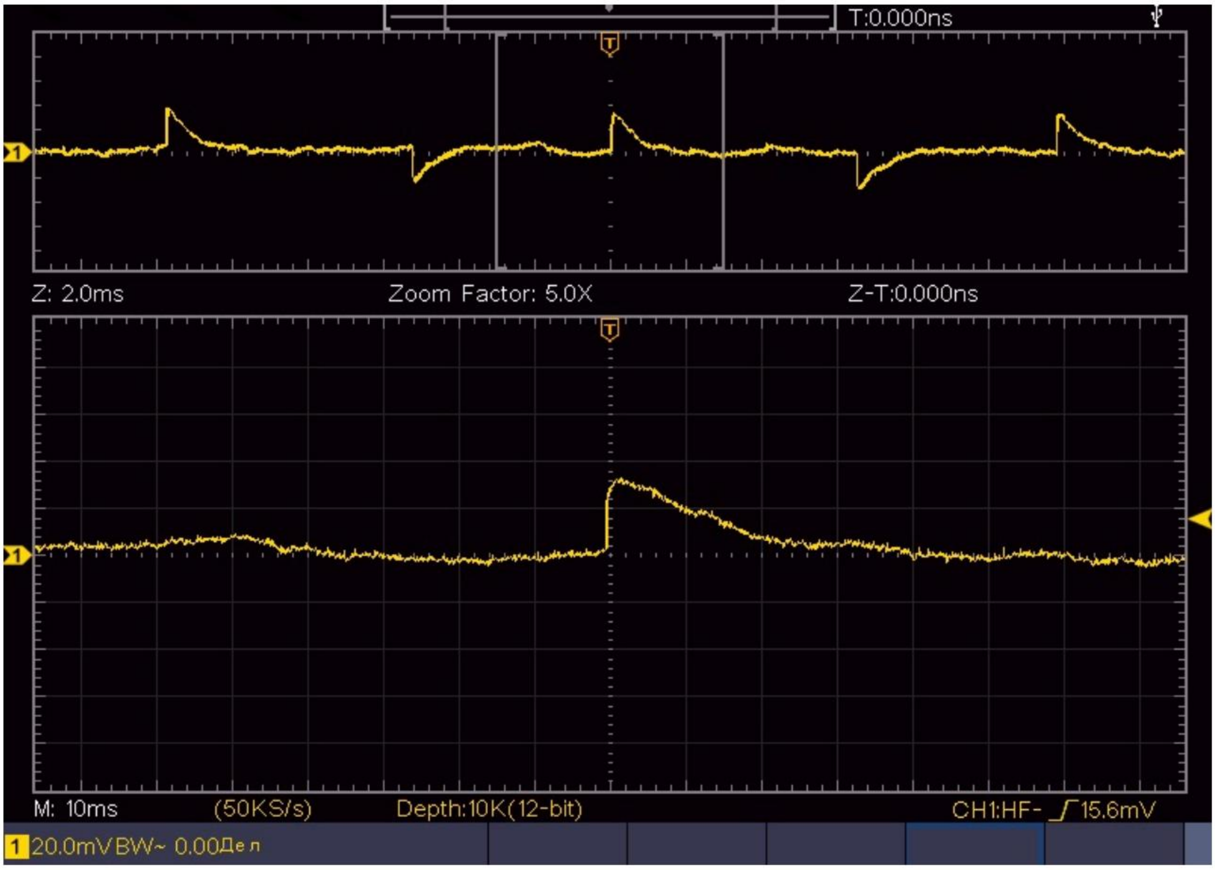
In this article, we will touch on an issue that is inextricably linked with the process of creating and testing audio equipment - a laboratory power supply. If the acquisition or manufacture of low-voltage sources does not present any particular problems, then with high-voltage sources such problems exist due to certain specific requirements. A variant of the implementation of such a source has already been considered earlier, its circuit is quite operable, but has a significant problem - insufficient protection against overloads and short circuits.

Your attention is invited to another version of the laboratory source. When designing the circuit, there were two main conditions: absolute protection against overloads, low self-noise level and, as a wish, a satisfactory impulse response.

A parallel regulator circuit was taken as a basis, in which the ballast resistor was replaced by a current source. This option was chosen not only because of its practical "indestructibility". In addition, such a stabilizer is a good "natural" filter and consumes a constant fixed current from the rectifier, this allows you to use a filter starting from the choke (significantly reduces the switching noise of the rectifier bridge) and eliminate transients in the filter during load current surges.

The regulator output voltage regulation range is 0.2÷300V, the maximum output current is 100mA, intrinsic noise is at the millivolt level, the transient process is aperiodic, and surges and dips (100% reset - load surge) do not exceed 30 millivolts (Fig. 1) .



Picture 1

Stabilizer circuit

The stabilizer circuit is shown in Figure 2 and does not have any features. On transistors VT1, VT2, a current source is implemented, resistors R5, R6 are current-setting, the reference voltage is formed by the DA1 microcircuit. In principle, it can be replaced with a conventional 5.1 volt zener diode, but this worsens the stabilization factor, because this circuit is powered directly from the rectifier.

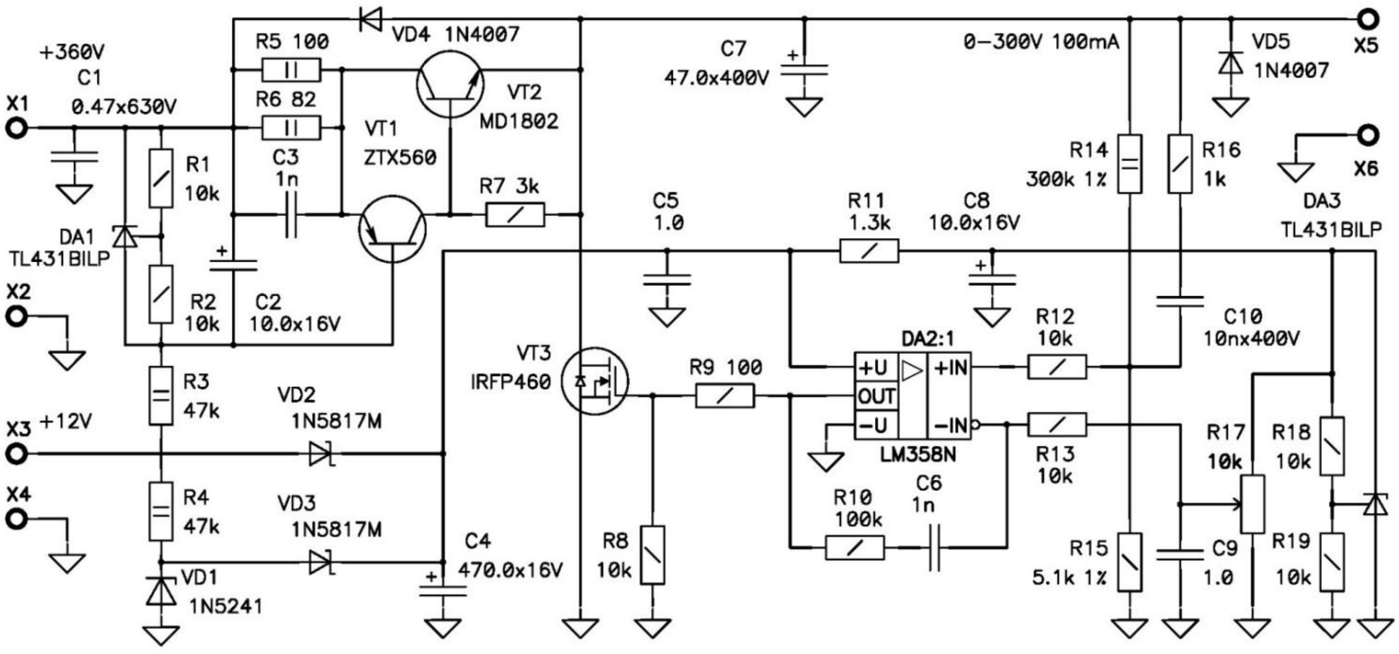


Figure 2

Regulating transistor VT3 is controlled directly from the output of the op-amp DA2, which works as an amplifier errors and comparison element. Its non-inverting input receives the output voltage from the divider, and inverting - reference voltage from a stabilizer assembled on a DA3 chip. If you turn off the a temporary resistor and apply voltage to the inverting input from an external source, for example, a sawtooth different shapes (0÷5V), the stabilizer can be switched to track mode, which is convenient for removing VAC lamps. The output voltage depends on the reference linearly.

The control circuit itself is powered by an auxiliary 12V source, this source is also feeds the radiator cooling fan of transistors VT2, VT3. The total power dissipation of both transistors stores does not exceed 40 watts in the worst case. To prevent the occurrence of overvoltage at the output when when the stabilizer is turned on or if the auxiliary source is faulty, a protective circuit is introduced VD1÷VD3. Regardless of the voltage decay rate on the main and auxiliary sources, the control circuit The relay will always receive power and try to maintain the specified voltage at the output.

The stabilizer is powered by the most common rectifier with a low-frequency power transformer (Fig. 3). Resistor R2 is used to reduce switching interference diodes VD1. Choke inductance L1 is not critical and can be within 15÷20H. It should be borne in mind that not any choke will fit here, since the operating alternating voltage on it can reach 200 volts.

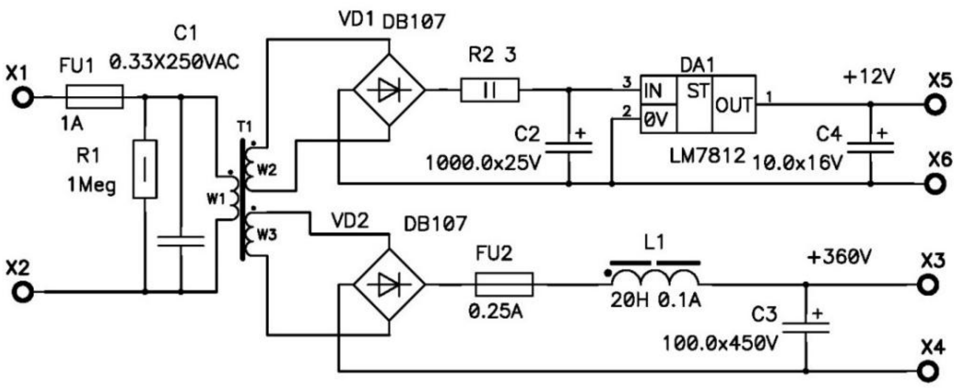


Figure 3

Construction and details.

Here a wide field for creativity is revealed, which, in general, I did. For power cooling transistors, a radiator from an old processor was used (maximum power dissipation - 90 watts). The fan is connected via a NTC thermistor (borrowed from a faulty power supply). computer) with a resistance of 120 Ohm (Fig. 4).

From the old UPS borrowed the core of the power transformer and the case itself with fittings. Transformer needs rewinding a core with an active area of 10÷13 cm2 (steel is specific there), and window area of at least 5 cm2 . Such transformers are used in UPS with rated power 400÷500 watts. Screen between network and secondary windings - mandatory, the winding data of the transformer are given in table below.

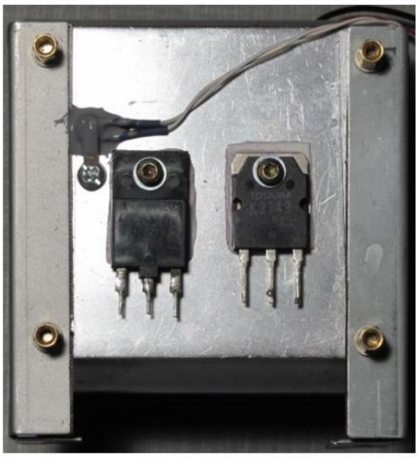


Figure 4

Winding ka	The number of vit- kov	The wire	Voltage Volt	Resistance Ohm
W1	845	PETV150- 0.33	230	27
Screen	1	Copper foil	-	-
W2	1600	PETV150- 0.21	400	120
W3	63	PETV150- 0.38	16	1.5

Of course, these data are approximate, since the final result depends both on the winding technology and and from the range of wires that are at hand. The most critical is the high output voltage. covoltage rectifier. Basic requirement at rated mains voltage: output voltage rectifier should be close to 360 volts. In accordance with this requirement, it is necessary to correct the accurate transformer data.

The hull has also been slightly modified. Its height was reduced, which is not at all necessary, and done this is purely for aesthetic reasons. Two large windows were cut out in the side walls and inserted a large-mesh mesh is used to ensure sufficient cooling of the power transistors (Fig. 5).

Figure 5

In the rectifier filter, a D51-NV type choke was used, the choke is not quite standard and is designed tan to work with large values of the variable component. Output voltage indicator - from kit Thai colleagues, the voltmeter turned out to be surprisingly accurate.

Due to the small number of components and the lack of replication plans, printed circuit boards are not developed foxes. The electronic part was assembled on breadboards (Fig. 6).

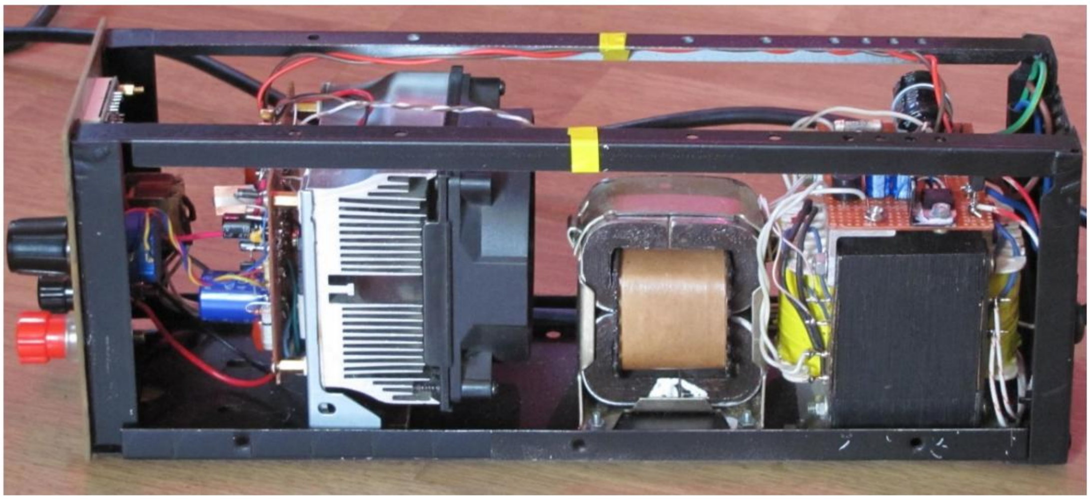


Figure 6

Now let's touch on the issue of choosing circuit components.

Regulating MOSFET can be of any type with an acceptable drain-source voltage of 400÷500 volts and dissipative output power 70÷100 watts (25ÿ°). To improve cooling conditions, it is desirable to use a transistor in the TO-247 case. The current source pass transistor must have a valid collector voltage. emitter of at least 500 volts and a dissipated power of about 50 watts. It is desirable to have a larger ÿ value at low collector currents. There are no special problems with the selection of power transistors.

A certain problem may arise with the transistor VT1. If the output is short-circuited, the stabilizer lyzer and the maximum mains voltage, it can dissipate power of about 0.5 watts. the best an option would be to use a 2SA1413 transistor. This was not at hand, so I used ZTX560, which was glued with thermal compound to a small piece of copper (approx. 1.5÷2 cm2).

The long-term stability of the output voltage is very dependent on the TCR resistors. dividers R14, R15 and R18, R19. Therefore, it is desirable to use precise resistors with low TCR (50÷100 ppm). If you use widely used metal oxide resistors (±350 ppm), then at maximum At the rated output voltage, the drift during warm-up can reach 1.5÷2%. In principle, this is not critical, but you shouldn't be talking about it.

To regulate the output voltage, it is better to use a multi-turn resistor.

The front panel was made without any special claims from a piece of 2 mm fiberglass (Fig. 7)

Adjustment of the stabilizer

If there are no installation errors and serviceable parts, the stabilizer starts working. bot right away. Stabilizer adjustment consists in setting the maximum output current and adjustment of the maximum output voltage.

To control and set the output current, it is necessary to short-circuit (before switching on) stabilizer output with an ammeter, turn on the stabilizer, and check the current short circuit. The short circuit current must be within 105÷110 mA. The magnitude of the short-circuit current is adjusted by changing the current-setting relay zistor.

Figure 7

The maximum output voltage is set after preheating. Mouth- set the maximum output voltage with resistor R17, adjust its value if necessary selection of resistor R15. Use in the output voltage divider circuit, any tuning resistors sides - undesirable.

If possible, it is necessary to check the absence of self-excitation of the stabilizer in the entire range of output voltages and the current shape of the filter inductor. The inductor current should not decrease to zero and should be close to sinusoidal in shape.

In conclusion, I want to remind readers that the device is high voltage, and care must be taken when setting up and operating it.

