POWERFUL STABILIZER WITH LOW VOLTAGE DROP

Evgeny Karpov

The article describes a relatively simple stabilizer to the average level output voltage (120-180V) and output current up to 1 ampere.

Brief background

In a sense, we can consider that this stabilizer is specialized, since it appeared as a result of the modernization of the "Princess" amplifier and was designed taking into account all the problems that arose during the operation of the amplifier. Despite this, the stabilizer can be successfully used to power the output stages of other amplifiers implemented on powerful lamps such as 6S33S, 6S18S, 6S41S, both with a transformer input and OTL. The focus was on two questions:
Minimizing the voltage drop across the regulator, which reduces heat generation and overall power of the power transformer. Expanding the functionality and increasing the reliability of the overcurrent protection system.

It is a well-known fact that the types of lamps listed above at a fixed displacement tend to self-heating, and it was thought that the presence of a servo system that controls the quiescent current lamps, can solve this issue. In life, everything turned out to be a little different. The fact is that the time constant of the controller is chosen large enough to completely eliminate its influence. to a sound signal, but the current rise rate of a lamp that has almost exhausted its resource turns out to be so high that the servo system does not have time to correct it. Naturally, this can lead to stabilizer failures.

Stabilizer circuit

The regulator circuit is shown in Figure 1. Structurally, this is a classic compensation regulator with a differential error amplifier (VT4-VT7). From the point of view of characteristics, there are not enough stars from the sky, but the quality of the output voltage is enough to feed output stage.

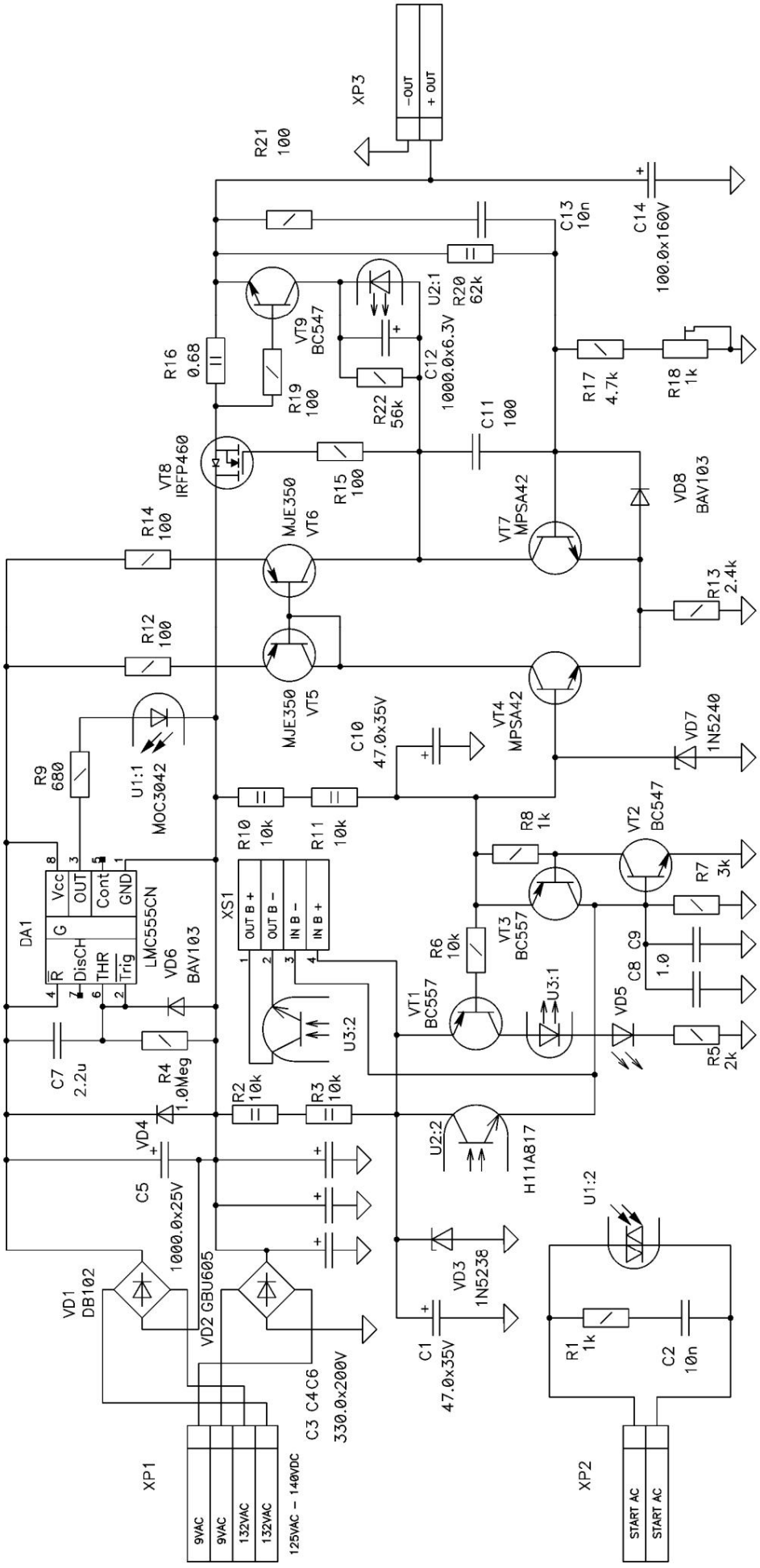
It has the following parameters:

Output voltage (with the divider shown in the diagram) Input voltage range	140V
Output voltage instability from the load current (jump 0-0.9A) Output voltage	145-200V
instability from the supply voltage Output resistance (in the LF region) Suppression of ripples	0.02%
with a frequency of 100Hz Transient time Protection operation current Delay blackouts	0.6%
	0.15ÿ
	ÿ46dB
	ÿ10mS
	ÿ1A
	ÿ200mS

Amplifier power was applied to reduce the minimum input voltage errors by increased voltage from an additional source (VD1, C5). This allows you to reduce the minimum voltage drop across the pass transistor to hundreds of millivolts (but the transistor must remain in linear mode). A protection circuit (R16, VT9) with an additional transistor was also used. This made it possible to reduce the maximum drop across the current sensor to 0.65 V and to obtain a steeper protection characteristic due to the high slope of the bipolar transistor. The stabilizer remains operational with a voltage difference between the input and output

about 0.8 - 0.9 volts.

The stabilizer uses a two-stage protection system. The first stage (R16, VT9) puts the stabilizer into the current source mode. In this case, the collector current VT9 begins to charge capacitance C12, which shunts the LED of the optocoupler. As the capacitance charges, the collector current begins to flow through the LED of the optocoupler, which causes an increase in the current of the optocoupler transistor U2:2. After approximately 200mS, the current through U2:2 will be sufficient to trigger the transistor analog of the dinistor (VT2, VT3).



Picture 1

The operation of the analogue of the dinistor will lead to a sharp decrease in the reference voltage of the stabilizer and, accordingly, to a decrease in the output voltage to 10-12 volts. The stabilizer will be in this state until the input voltage is completely removed. Transistor VT1 performs auxiliary functions. The operation of the second stage of protection leads to its unlocking, lighting of the overload indicator LED (VD5) and unlocking of the optocoupler transistor U3. Optocoupler U3 is used to create cross connections of stabilizer protection systems with bipolar power supply of the output stage. Thus, operation

protection in any stabilizer leads to automatic shutdown of the second. If this function is not required, optocoupler U3 and connector XS1 can be omitted.

The stabilizer is integrated with a soft starter on a timer (DA1) and an opto-triac U1. When the supply voltage is applied to the stabilizer, the power rectifier (VD2) is connected to the transformer winding through a starting resistor, which limits the charge current of the stabilizer capacitances. After the end of the delay, the optotriac turns on, which leads to the activation of the relay, which closes it with its contacts.

Construction and details

It is advisable to implement the stabilizer on a printed circuit board, which is placed directly directly on the cooler of the pass transistor VT8. In any case, it is necessary to minimize the length of the conductors connecting the pass transistor to the rest of the circuit. Requirements to tracing of printed conductors is standard for stabilizers - with a clear separation of power and signal circuits and with their connection at one point at the output. Resistor R15 must be soldered directly to the gate of the transistor VT8. It is better to use a tuning resistor R18 multi-turn, and even better - after adjusting the output voltage level, replace it with a constant resistor of the corresponding rating.
cash.

There must be adequate clearance between the output circuit of the optocoupler U1 and the rest of the circuit, especially when using a relay powered directly from the mains voltage.
niya.

There are no special requirements for semiconductor components, you can safely use any components with similar basic parameters (it is not recommended to use components manufactured by unknown by whom and where). Types of electrolytic containers - for your taste, of course, it is more correct to use low impedance capacitances. But, as practice has shown, containers of general use (well-known manufacturers) successfully cope with their task.

If necessary, significantly change the level of the output voltage - it is necessary recalculate the resistor values of the divider R17, R18, R20. The divider is calculated according to the following criterion: at the nominal voltage at the output, the voltage at the base of the transistor VT7 must be equal to 10.65 volts (the base current of the transistor is at the level of 18÷20μA). Naturally, it will also be necessary to correct the operating voltages of the electrolytic containers. The delay time for turning off the stabilizer during overload can be varied by changing nominal capacitance C12. The threshold value of the protection operation current can be powerfully corrected by changing the value of the resistor R16. The required resistor value can be determined from the relation
niya:

R16=0.65/I (ÿ), where I is the threshold current of the protection operation (A).

If there are no errors in the installation and serviceable components, the stabilizer starts working. thief immediately and only requires fine tuning of the output voltage level.