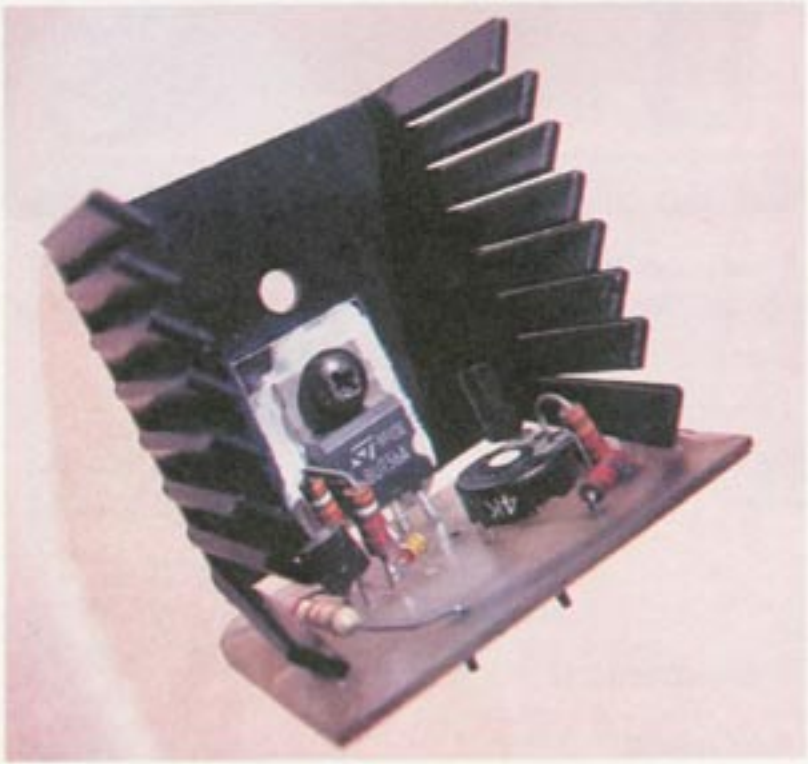
Sanken STR4XX Substitute



Michael Dranfield describes a compact, discrete-component replacement module for the Sanken STR4XX range of chopper chips, which are now obsolete. It can solve the problem with many sets that are otherwise uneconomic to repair

The Sanken STR4XX series of chopper chips has been obsolete for some time now. As a result, the prices quoted for them has soared. Take for example the STR451, which is used in the Amstrad CTV1400 14in. colour portable. I have seen prices as high as £29 quoted for this device. Add a £30 labour charge, then VAT, and the set becomes uneconomical to repair.

The Sanken four-terminal (three pins plus case) STR4XX series of ICs provides a range of fixed, non-adjustable output voltages. These voltages range from 102V with the STR442 to 130V with the STR453. As the output voltage is fixed, it is not possible to use an alternative device. So what happens to sets that use these chips? The project described in this article provides a discrete-component plug-in substitute. It has the advantage that the output can be adjusted over the range 85-140V by means of an on-board preset. As a result, it can be used to replace the entire STR4XX range of devices.

Circuit Operation

The STR4XX chip forms the active device in a chopper power supply based on the blocking oscillator principle. It operates with feedback pulses from the line output stage so that the chopper and line output stages run in synchronism to avoid beat patterning.

Fig. 1 shows the power supply circuit used in the Amstrad Model CTV1400. At switch on the mains bridge rectifier produces some 320V across its reservoir capacitor C502. The base of the chopper transistor in IC502 then receives forward bias via R503 and R505, which are sometimes referred to as the start-up resistors. Thus the chopper transistor switches on and current flows through the primary winding of the chopper/blocking oscillator transformer T501. C504 on the output side of the circuit charges, with D507 present to provide overvoltage protection.

Positive feedback via C503 and R504 drives the transistor to saturation. These two components set the free-running frequency of the oscillator circuit. When the transistor saturates, there is no longer any change in the current flowing in the transformer's primary winding and the positive feedback comes to an end. The charge across

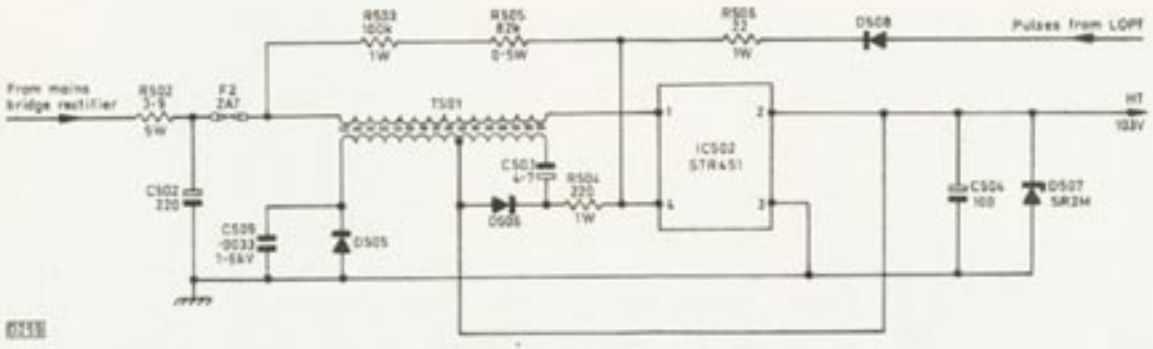


Fig. 1: Chopper power supply circuit used in the Amstrad Model CTV1400.

C503 reverses, switching off the chopper transistor. In the free-running state C503 then discharges via R504, R505 and R503 and in due course the chopper transistor switches on again. In normal operation however pulses from a tap on the line output transformer, fed via D508 and R506, switch the chopper transistor on, thus synchronising the operation of the chopper and line output stages.

Substitute Module Circuit

Fig. 2 shows the circuit of the substitute STR4XX module. Q1 is the chopper transistor, with Q2 controlling the DC conditions at its base. These are in turn set by the error amplifier transistor Q3. This transistor's emitter voltage is clamped at 6·8V by zener diode D1. Its base is connected to the preset control R4, which is part of a potential divider network (R2, R4, R5 and R7) across the HT supply. With the resistor values given in the components list, the HT is around 100V with the slider of R4 at approximately the mid-track position.

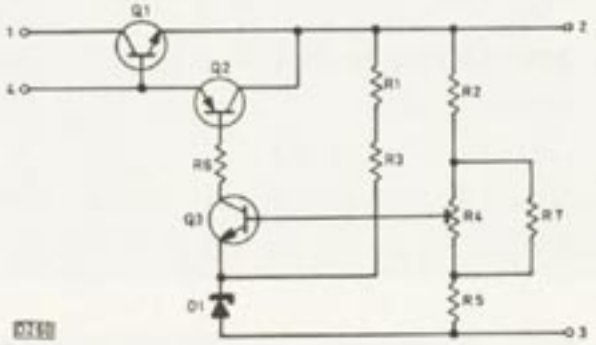


Fig. 2: Circuit diagram of the STR4XX substitute

Construction

Although the prototypes use a custom-made PCB, full constructional details are not included as the board design will vary from set to set. For example a 22in. Hitachi set that uses the STR4XX device will need a heatsink twice the size of the one used for a 14in. colour portable. The module illustrated has a 7·1°CW heatsink. This is adequate for most 14in. portable sets. A basic PCB layout is shown in Fig. 3.

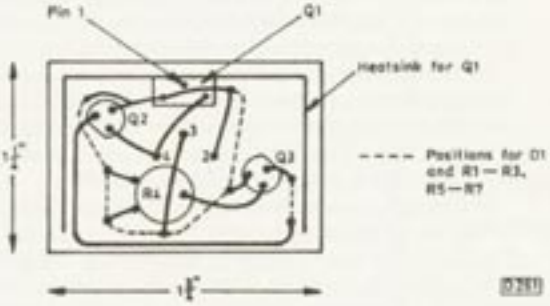


Fig. 3: Basic module PCB layout.

Installation

Note the following points before fitting one of these substitute modules to a TV set.

First, most sets that use this type of circuit employ an avalanche diode across the output (D507 in Fig. 1) to provide protection against excessive HT voltage. If the original STR4XX device had gone short-circuit the avalanche diode will also be short-circuit. In this case Q1 in Fig. 2 will be destroyed at switch on. So check on this first. Remove the avalanche diode before fitting the substitute module.

Next, disable the line output stage, say by disconnecting the base of the line output transistor to remove its drive. Connect a 60W bulb across the module's HT output. Now switch on and, using a digital voltmeter, adjust the preset control R4 for the required HT across the bulb. In the Amstrad Model CTV1400, which uses the STR451 chip, this is 103V.

If the power supply is working correctly, switch off, refit or replace the avalanche diode, reconnect the line output stage, remove the 60W bulb and switch on. With the line output stage running, the HT voltage will have risen by a few volts. So readjust R4 for the exact voltage required. Table 1 shows the correct output voltages for the various chips in the STR4XX range. ■

Table 1: Output voltages

Chopper chip	*HT*
STR440	107V
STR442	102V
STR450	115V
STR451	103V
STR452	123V
STR453	130V

Component details

Q1	BUT56A	R2	47kΩ
Q2	2SA1015	R3	39kΩ
Q3	2SC1815	R4	4·7kΩ
D1	6·8V, 400mW	R5	2·7kΩ
		R6	22kΩ
R1	3·9kΩ	R7	3·3kΩ

All fixed resistors 0·5W, 2%
R4 is a miniature preset

Heasink for 14in. sets Farnell type 179-935.

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