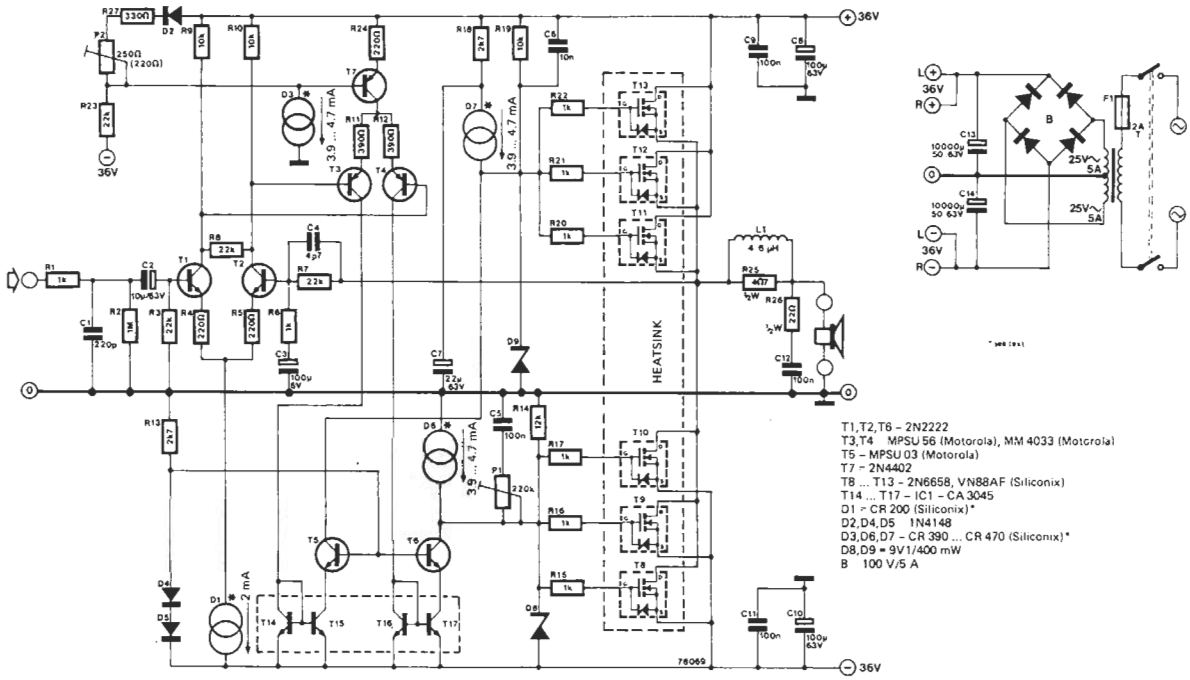
FET audio amplifier 39



Power FETs have been used in a number of Japanese audio amplifiers for some time now, and indeed were discussed in Elektor No. 14, June 1976, p. 628. Readers are referred to this article for a full discussion of the application of power FETs in audio amplifiers. Using power V-FETs manufactured by Siliconix it is now possible to present a FET audio amplifier design suitable for home construction, which is based on a Siliconix application note. The advantages offered by V-FETs in audio output stages are considerable. The 2N6658 used in this circuit has a cutoff frequency of 600 MHz, and yet is completely free from the secondary breakdown problems that bedevil high-frequency bipolar transistors. The current gain of a V-FET is virtually infinite, the transfer characteristic is extremely linear for drain currents greater than 400 mA and the temperature coefficient of drain current is negative, thus eliminating thermal runaway problems. The maximum drain source voltage of the 2N6658 is 90 V, which is more than adequate for audio amplifier applications. However, the maximum drain current is only 2 A and the maximum dissipation 25 W, so a number of V-FETs must be connected in parallel in the output stage of the amplifier (T8 to T13). The same type (polarity) of FET is used in each halve of the output stage. and the two halves of the output stage therefore require antiphase drive signals. This is easily achieved, as antiphase signals are available as far back in the circuit as the input stage, which consists of a long-tailed pair T1/T2. The antiphase signals from the collectors of the input stage drive a second long-tailed pair T3/T4, the antiphase outputs of which feed two driver stages, T5/T14/T15 and T6/T16/T17, each of which comprises a current mirror and cascode stage.

Provision of DC biasing throughout the amplifier is simplified by the use of constant current (Norton) diodes. It should be noted that, although any type of Norton diode from CR390 to CR470 may be used for D3, D6 and D7, they must all be the *same* type.

With the power supply shown, which is adequate for a stereo version of the amplifier, the circuit will deliver an output of 40 W per channel into 8 ohms with a harmonic distortion of 0.04% at 1 kHz. Clipping does not occur until 55 W into 8 ohms, but above 40 W the distortion will gradually increase. The slew rate of the amplifier is 100 V/µs, and the output is short-circuit proof.

Finally, a few practical hints on constructing and setting up the circuit. The six output FETs should be mounted together on a single heatsink with a thermal resistance of less than 2°C/W. The gate resistors R15 to R22 should be mounted as close as possible to the gate leads of the FETs.

For setting up the amplifier, it should temporarily be connected to a stabilised power supply with the current limit set to between 500 mA and 1 A. Alternatively a 100 ohm 10 W resistor may temporarily be connected in series with the drain lead of T8 . . . T10 and of T11 . . . T13 to limit the current. Before applying power P1 and P2 should be set to maximum resistance and a milliameter connected in the positive supply lead. When power is applied the current consumption should be about 40 mA. P2 should then be adjusted until the supply current shows a sharp increase, after which the amplifier should be left for about 5 minutes to warm up. The supply current may then be adjusted to between 200 and 350 mA using P2. Finally, P1 should be adjusted to give minimum distortion at an output power of 10 W into 8 ohms with a 1 kHz sinewave input. However, if equipment is not available to carry out this adjustment P1 may simply be set to its mid-position or adjusted by ear.

Literature.

Siliconix Application Note AN 76-3 and Design Aid DA 76-1.