Mini Amplifier

A small amplifier circuit is described here for the readers who are always looking for a practical project. The description 'Mini' does not apply to the performance of the amplifier, it applies to the size, and number of components required.

A full fledged amplifier generally consists of two main stages, a pre amplifier to amplify the signal coming from the signal source like a Tuner, Cassette-player or a record-player, and the power amplifier which amplifies the signal further and delivers the driving power to the loud speaker.

The circuit's presented here takes care of the second function. It raises the signal level coming from the pre amplifier and delivers the driving power to the loudspeaker. It can give a maximum of 10 Watts to a suitable loudspeaker. It is built around a single IC and a few additional passive components.

The Circuit

The main component of the circuit illustrated in figure 2 is the amplifier IC TDA 2003 (which can also be substituted by another IC TDA 2002 without affecting the performance)

It is a compact integrated low frequency amplifier suitable for output capacities upto 10 Watts.

Only a few passive components (resistors and capacitors) are necessary to complete the amplifier circuit.

The input signal is given to the IC through capacitor C1 This is amplified by the IC and is available at the output pin 4. The gain of the amplifier is decided by the ratio of resistances R1

1

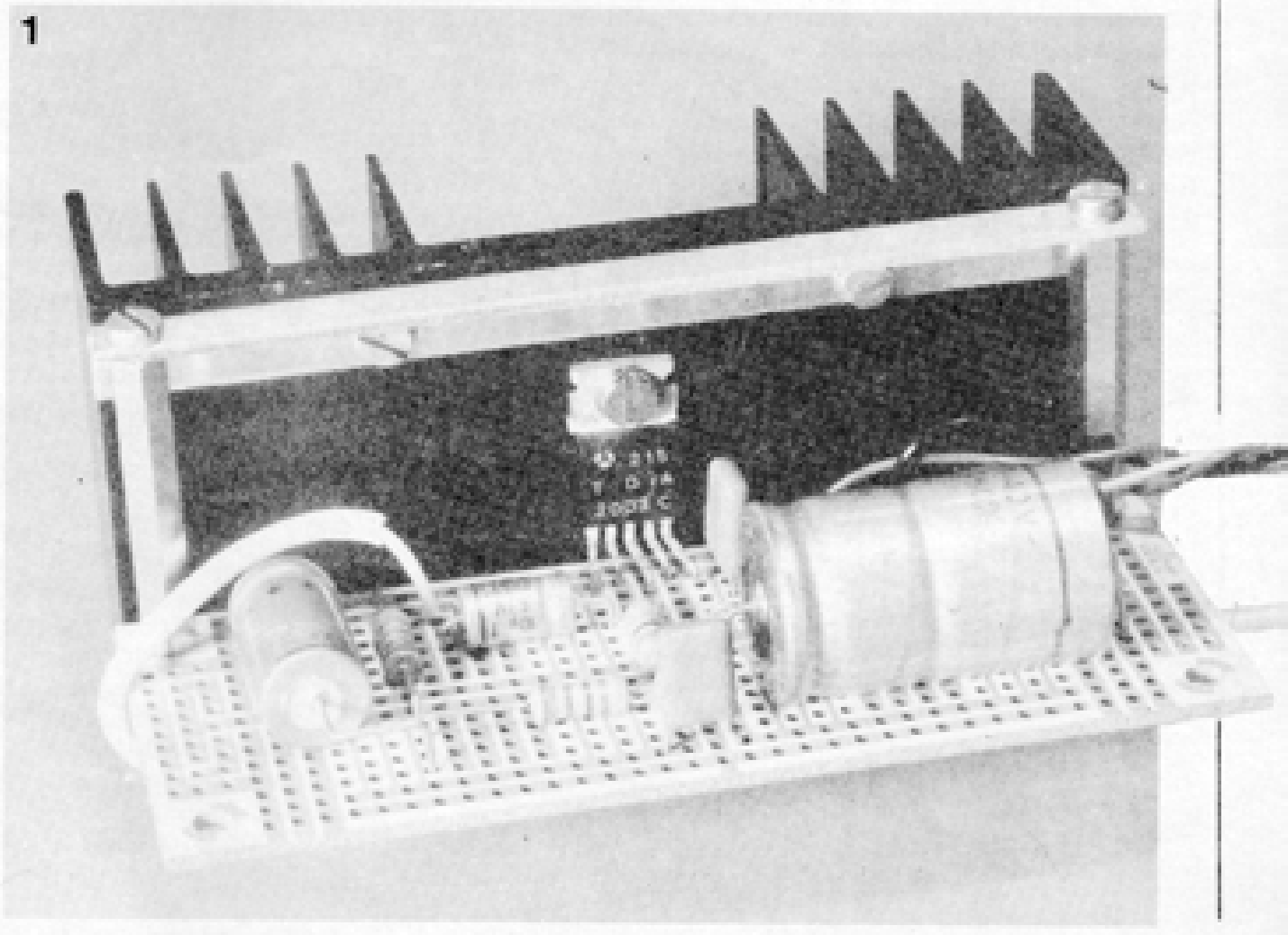


Figure 1 :
Fully assembled 'Mini Amplifier'

and R2. This is equal to 100 in the present circuit, with the selected values of R1 and R2 as 220Ω and 2.2Ω respectively. The bandwidth of the amplifier is decided by the RC combination R4 and C7. With the selected values of 47Ω for R4 and 100nF for C7 the bandwidth available is 33KHz. If the input signal is within this range, the amplifier works without any loss of amplification. However, for signals with frequencies above 33KHz, the amplification falls rapidly.

The output signal available at pin 4 of the IC is supplied to the loudspeaker through the capacitor C4. The impedance of the loudspeaker finally decides the output power. If the supply voltage is 18 volts, the output power available from a 2Ω loudspeaker is full 10 Watts. A 4Ω loudspeaker gives 6 Watts and an 8Ω loudspeaker delivers just 1.5 Watts.

The RC combination R3, C5 is connected accross the loudspeaker to avoid unstable operation of the entire circuit.

The no load current drawn by the amplifier is about 50 mA. It draws about 500 mA when delivering 6 Watts power through a 4Ω loudspeaker and can go upto 1A when delivering 10 Watts through a 2Ω loudspeaker. The input signal being a 1 KHz sine wave and the supply voltage at 18 V.

If the power amplifier is used in a car radio or cassette player the power supply can be directly taken from the car battery. Though the maximum specified supply voltage is 18 Volts, the amplifier can be operted from lower voltages.

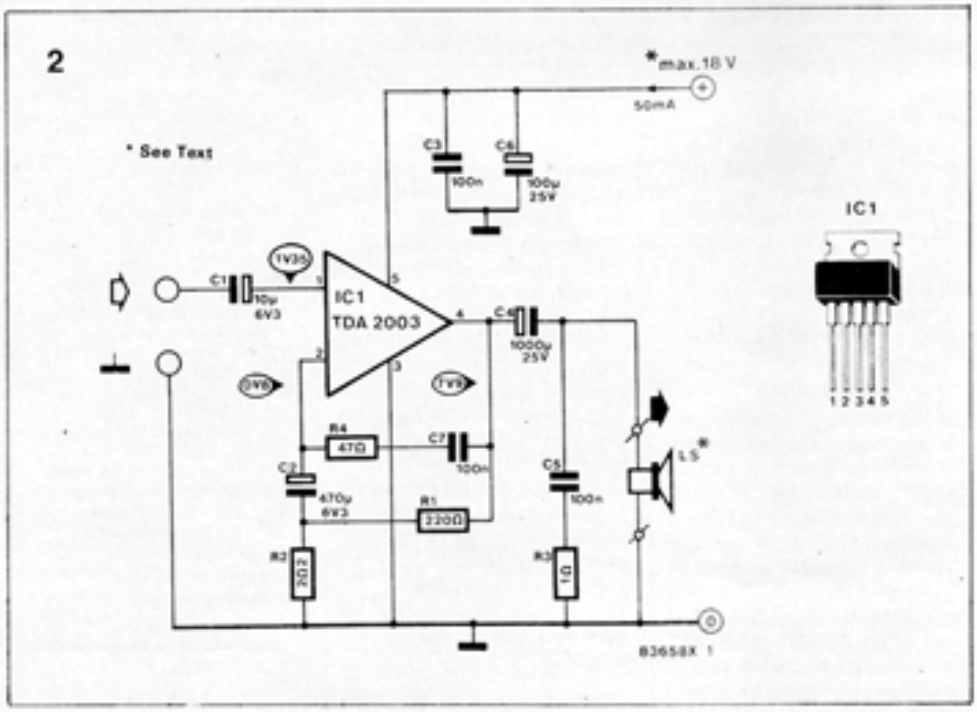
A battery eliminator circuit is also presented here in gifure 3 for those who want to operate the amplifier from mains supply.

It is a simple battery eliminator circuit with a 12V/1.5A transformer, a bridge rectifier consisting of 4 diodes of the type 1N 4002 and an electrolytic filter capacitor of 1000 uF/25 V. This gives a no load voltage of about 16V. The supply voltage to the IC should not be more than 18V in any case. Though the IC can tolerate upto 28V without any damange, the performance of the amplifier is affected beyond 18V and the volume drops to zero.

Construction

The component layout of the circuit on a size 1 SELEX PCB is shown in figure 4. The layout is very simple and everything except the loudspeaker and the battery eliminator fits on the PCB.

The assembly should be carried out in the usual sequence - jumper wires, resistors, capacitors and then finally the semiconductors. The fully assembled PCB is shown in photograph 1, which clearly shows the construction details. It also shows how the heatsink is fitted to the PCB and the IC cooling fin. the cooling fin of the IC is internally connected to pin 3 which is externally connected to the ground line. No mica washers are therefore necessary between the IC and the heat sink. Care should be taken while mounting the heatsink that the mounting screws on the PCB do not short the heat sink with any other tracks, because the heat sink is connected to the ground line through pin 3 of the IC. There should be a gap of about 2 to 3 mm between heat sink and the PCB.



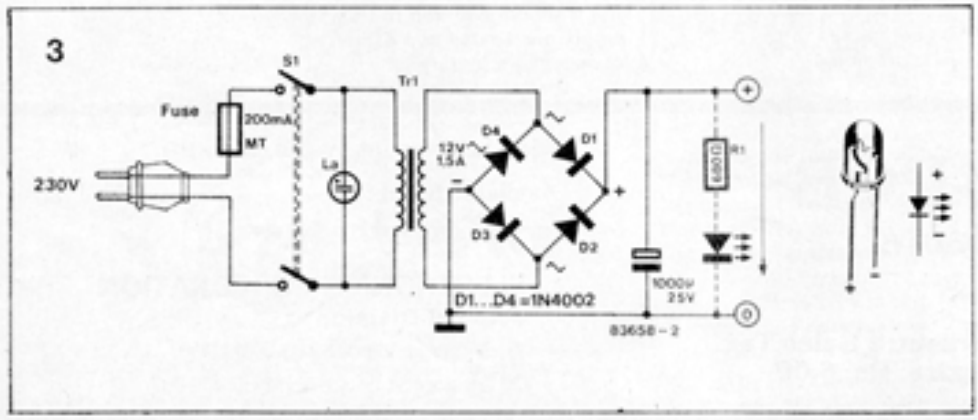
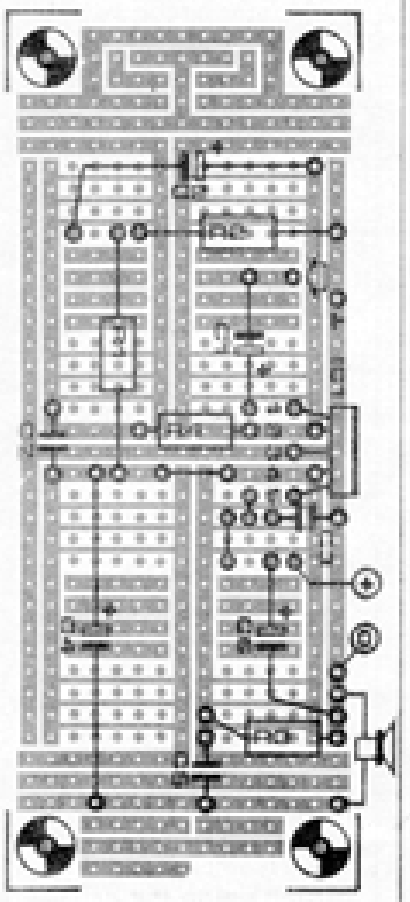


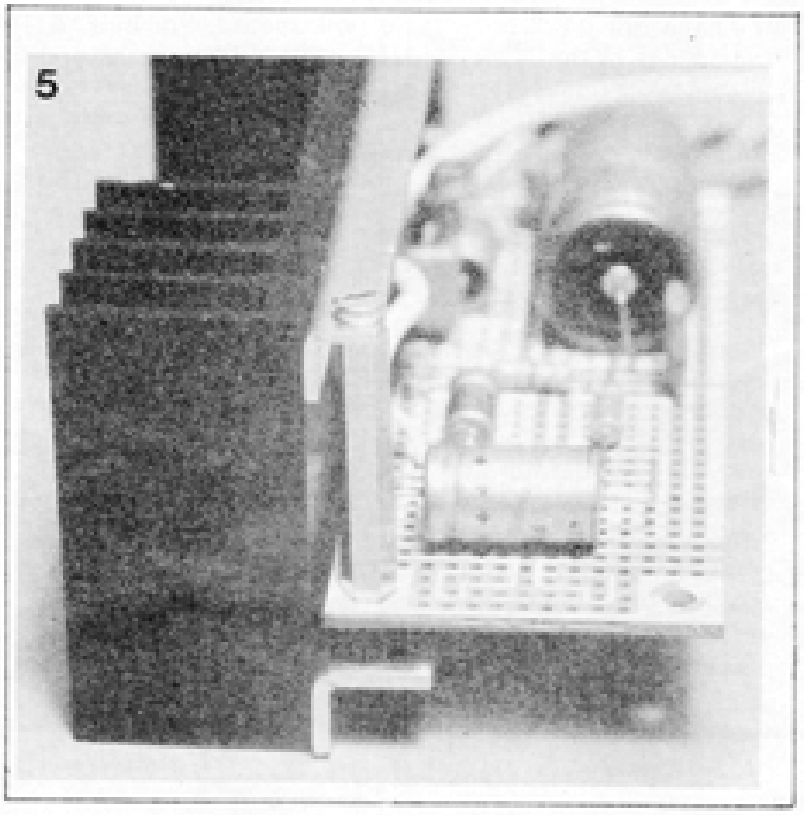
Figure 2 :
Complete Circuit diagram of the Mini-Amplifier.

Figure 3 :
Simple battery eliminator circuit for use with the Mini-Amplifier.

4



5



6

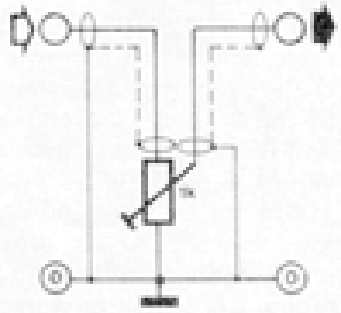


Figure 4 :
Component layout on SELEX PCB, which accomodates everything except the loudspeaker and battery eliminator.

Figure 5 :
2 to 3 mm airgap available between the heat sink and the PCB.

Figure 6 :
Volume control to be provided in case of connection to high output pre amplifiers.

The battery eliminator circuit must be constructed separately as it has no space on the main PCB. The output of the battery eliminator must be connected through a cable to the amplifier PCB at the terminals marked + ad O.

Testing

When the assembly is complete, the first test can be carried out. The input is connected to the ground line, and a suitable loudspeaker is connected at the output. A multimeter is inserted in the supply line to measure the no load current. The measuring range is set to 100 mA. As soon as the supply is switched on, the meter should read about 50 mA, and the loudspeaker must not make any sound. (Because the input is connected to the ground line.) If one or both of these indications are not there, immediately switch the power off. Check the PCB for faulty connections or short circuits if any.

If the first test is passed, then remove the multimeter from the supply line and connect the output of the eliminator directly to the amplifier PCB. Now you can check all the DC voltages marketed in the circuit diagram of figure 2. If these are all as per the specified values, you are ready to operate your amplifier. The short circuit between the input and ground can now be removed and the input can be connected to the output of a preamplifier.

If an 18V supply is used and the loudspeaker has an impedance of 2Ω then the preamplifier output required to drive the amplifier at full load is about 45 mV. A 50 mA signal is required if the loudspeaker has an impedance of 4Ω or 8Ω. If you expect the preamplifier to deliver a higher output signal, then a potentiometer must be used in the input circuit as shown in figure 6. The connection between the preamplifier and the power amplifier must be through a shielded cable, with the shield connected to the ground and the core connected to the signal. This precaution reduces the hum pick ups by the amplifier.

It is generally very difficult to obtain 2Ω loudspeakers, and a simple solution to this problem is to use two 4Ω loudspeakers in parallel.

Component List :

R1 = 220Ω
R2 = 2.2Ω
R3 = 1Ω
R4 = 47Ω
C1 = 10μF/6.3V
C1 = 470μF/6.3V
C1 = 470μF
C3 = 100nF C2
C4 = 1000nF/25V
C5 = 100 nF
C6 = 100 μF/25V
C7 = 100 nF
IC1 = TDA 2003/TDA 2002
LS = 2Ω 10W Loudspeaker
LS = 4Ω 4W Loudspeaker
LS = 8Ω 3W Loudspeaker

Other parts

1 SELEX PCB Size 1
1 Suitable heatsink.

Aluminium angle and spacers for mounting heatsink.