Extra amplification is desirable in almost every extended video chain. We are talking about, for example, compensating for losses in cables, strengthening the signal from a not very sensitive input, or other applications where signal levels have to be tuned in to each other.
This simple amplifier is ideal for all these applications. Furthermore it also acts as a distributor as it is equipped with three outputs as standard.

video amplifier

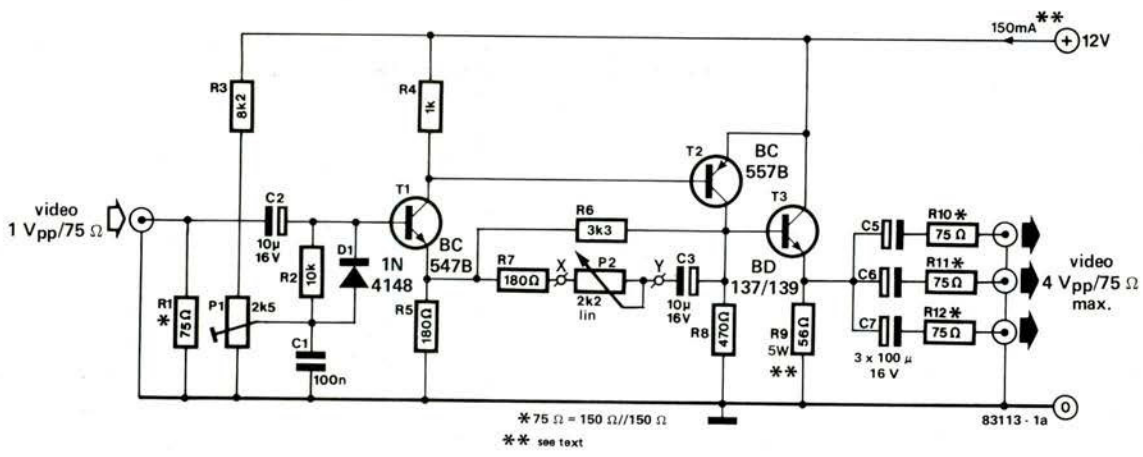
universal amplifier and distributor for video signals

A video amplifier rarely needs a high gain. By 'high' we mean a factor of 100 or more, as is the norm for audio pre-amplifiers. For adjusting video levels a gain factor of 2 or 3 times is generally called for – maybe a bit more in a few cases.
In this circuit we have made the amplification adjustable between 1 x and a good 4 x, so that the amplifier is suitable for almost any situation where boosting is needed. The maximum output voltage is 4 V_{pp}, and the input and output impedance is, of course, set at 75 ohms.
As well as being a normal amplifier, this circuit can also be used as a video signal distributor, which is handy if more than one channel in a video chain are to be driven from one video signal. As we have already said, the amplifier has three outputs. However, that is not to say that they all have to be used. The circuit can also be used with just one or two outputs.
Now the only data needed to complete the technical specification of the amplifier is the bandwidth. This is at least 5 MHz providing the specified semiconductors are used.

The circuit diagram

A good video amplifier need not be very complicated, as is shown by figure 1a. The circuit contains a very ordinary two-stage amplifier (T1/T2) followed by an emitter follower. The transistors used are simply normal BC and BD types because these can quite easily fulfil the required conditions for adequate bandwidth. A nice side-effect is, of course, that these transistors are relatively cheap, and in this case expensive HF types are simply not needed.
The input impedance is set to 75 ohms by R1. The signal travels from the input via C2 to the base of T1. Because the content of the video signal can change a lot, the d.c. current setting of T1 is provided by a small circuit (R3, P1, C1, R2 and D1). The maximum output voltage swing of the amplifier can be set using P1. We will deal with setting this potentiometer later. The base of transistor T2 is connected directly to the collector of T1 thus forming a direct coupled amplifier, the amplification of which can be varied with potentiometer P2 in the feedback network. The amplification factor is defined by the ratio between R5 and the resistance of the R6/R7/P2/C3 network. With the values we have used, P2 covers a range of 1.95 x to 8.7 x. With the

1a



1b

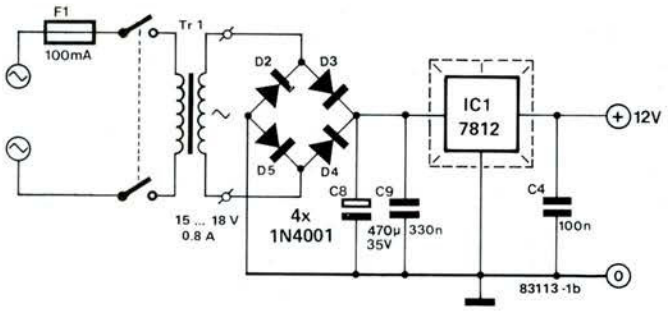


Figure 1. The circuit is very simple to construct and contains very ordinary components. The amplification can be adjusted with P2 between 1 x and 4 x.

normal output load of 75 ohms the final amplification is effectively halved, so that the actual range is from 1 x to just over 4 x.

The T1/T2 stage is followed by a 'bigger' transistor (T3), which has to ensure the desired low frequency output impedance. This demands a very small emitter resistor (R9) and an accordingly high collector current. The amplified signal leaves the circuit by three 75 ohm outputs, made up of C5/C6/C7 and R10/R11/R12.

If only one or two of the three outputs are needed, then obviously the power consumption of the circuit will be correspondingly less. The greatest part of the current consumption is in R9. If three outputs are used R9 must be 56 ohms, with two outputs it can be increased to 82 ohms and with one output 150 ohms is sufficient. The total current consumption for the three conditions is then 150 mA, 110 mA and 70 mA respectively.

Adjustment

There are two ways of adjusting P1. The 'normal' method, which gives satisfactory results 90% of the time, and an alternative for setting it up 'by eye'. In the first case, P1 is simply adjusted so that there is about 1 V at the base of T1. The voltage across R8 should then be about 7.5 V (with no signal).

The alternative method is somewhat more involved. Start by setting P1 to mid position and with an input signal of about 1 V_{pp} reduce the amplification to minimum with P2. Then a test image is fed into the input (from a video recorder, for example), and a TV set or monitor is connected to the output. P1 is now adjusted so that all distortion is just eliminated.

Another point which may be of importance. Although input signals a bit higher than the nominal 1 V_{pp} are not a direct disadvantage to the amplifier, they are actually of little use. Significantly higher voltages can therefore better be reduced. This can be done by experimenting with R5 and using a bigger resistor here (the maximum amplification then decreases) or by placing an extra resistor in series with the input, so that it forms a voltage divider with R1. Then the value of R1 is reduced so that the total resistance of the extra resistor and R1 add up to 75 ohms.

Construction

A simple power supply for the amplifier is easily built, as figure 1b shows. Both amplifier and power supply are constructed on the same printed circuit board, the layout

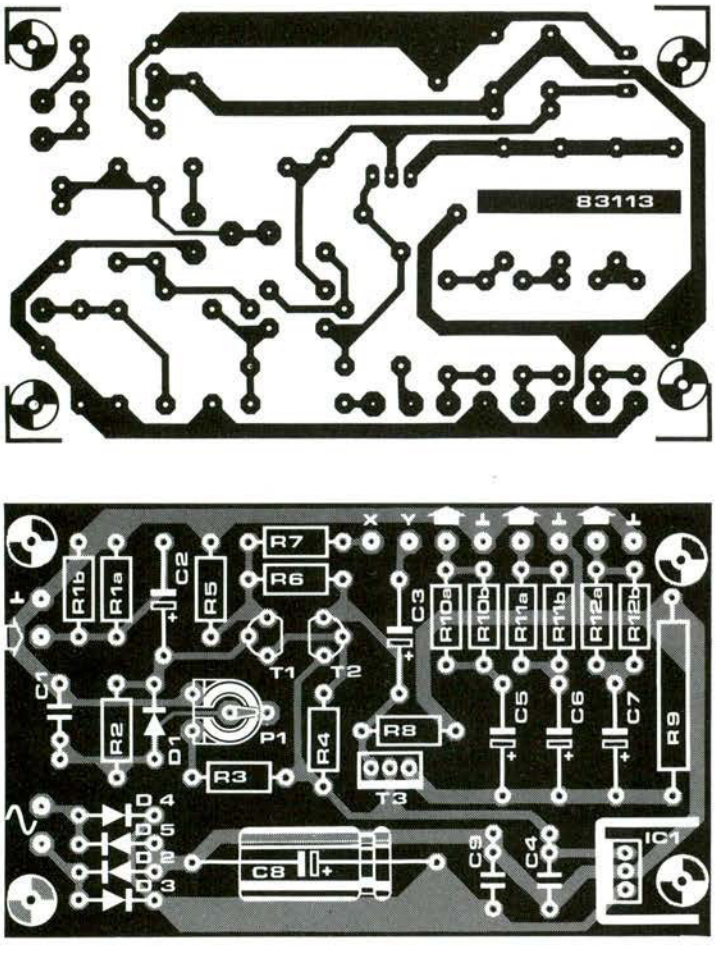
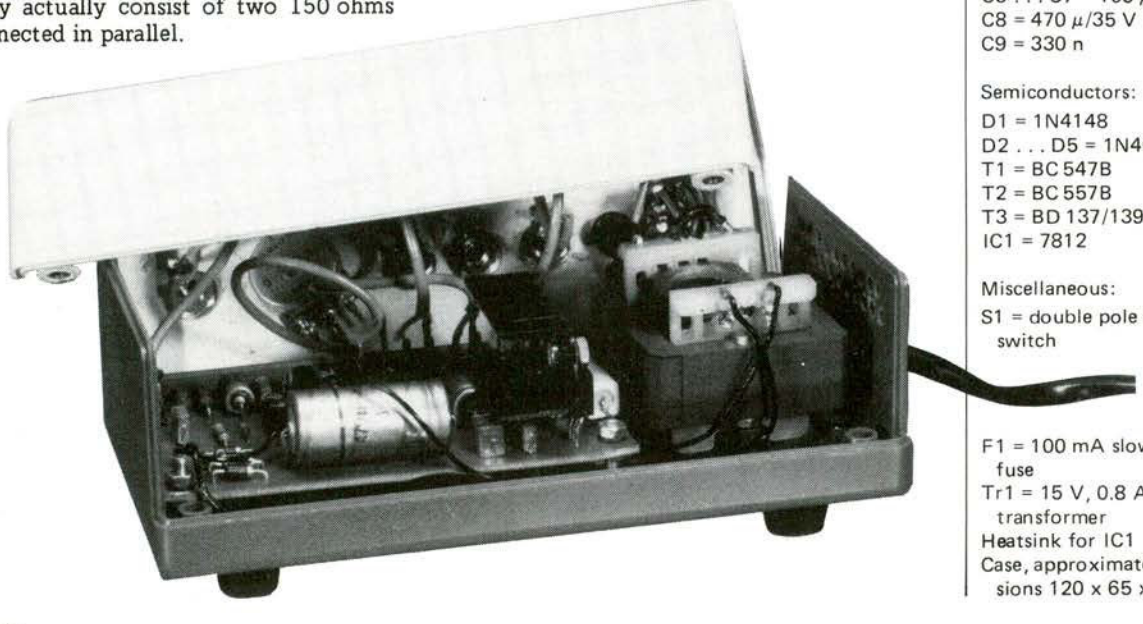


Figure 2. The printed circuit board contains both the amplifier and power supply. Only the mains transformer is not mounted on the board.

of which is shown in figure 2.
'Construction' is really only a matter of fitting everything correctly to the printed circuit board and soldering it there. However, there are a few points to note. When three outputs are in use voltage regulator IC1 has to work reasonably hard and because of this it needs to be mounted on a heatsink. The 75 ohm resistors (marked with an asterisk) are not standard E12 values. They actually consist of two 150 ohms connected in parallel.

Very little needs be said about mechanical construction for this project. Depending on circumstances, it could be built into the case of some existing equipment, or it could be mounted in a case of its own. The only important point is that the 'amplification' pot must be freely accessible. ◀



Parts list

Resistors:
R1,R10 . . . R12 = 75 Ω*
R2 = 10 k
R3 = 8k2
R4 = 1 k
R5,R7 = 180 Ω
R6 = 3k3
R8 = 470 Ω
R9 = 56 Ω/5 W**
P1 = 2k5 preset
P2 = 2k2 linear
*75 Ω = 150 Ω ‖ 150 Ω
**see text

Capacitors:
C1,C4 = 100 n
C2,C3 = 10 μ/16 V
C5 . . . C7 = 100 μ/16 V
C8 = 470 μ/35 V
C9 = 330 n

Semiconductors:
D1 = 1N4148
D2 . . . D5 = 1N4001
T1 = BC 547B
T2 = BC 557B
T3 = BD 137/139
IC1 = 7812

Miscellaneous:
S1 = double pole mains switch
F1 = 100 mA slow blow fuse
Tr1 = 15 V, 0.8 A mains transformer
Heatsink for IC1
Case, approximate dimensions 120 x 65 x 65 mm