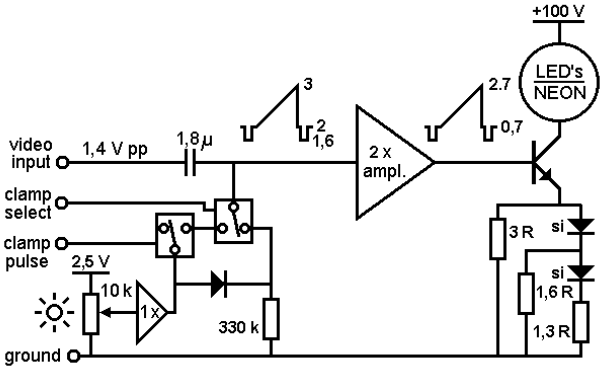
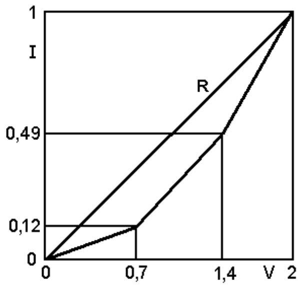
Video amplifier - LED/neon driver

This NBTV video amplifier works directly from an input video signal of 1 volt black to white, or 1,4 volts including sync pulses. It can drive a NEON lamp as well as a (long) chain of LEDs. It includes gamma correction for an improved display of shades of grey.
When 40 orange ultra bright LED's are connected in series the overall voltage is the same as for a small neon lamp (85 volts). A DC power supply of about 100 volts is therefore suitable for both types of light source, without the need for any circuit changes. If you want to change the LED driver to a lower voltage and higher current, this can be done easily by recalculating the resistor values in the gamma correction circuit.

Simplified Diagram

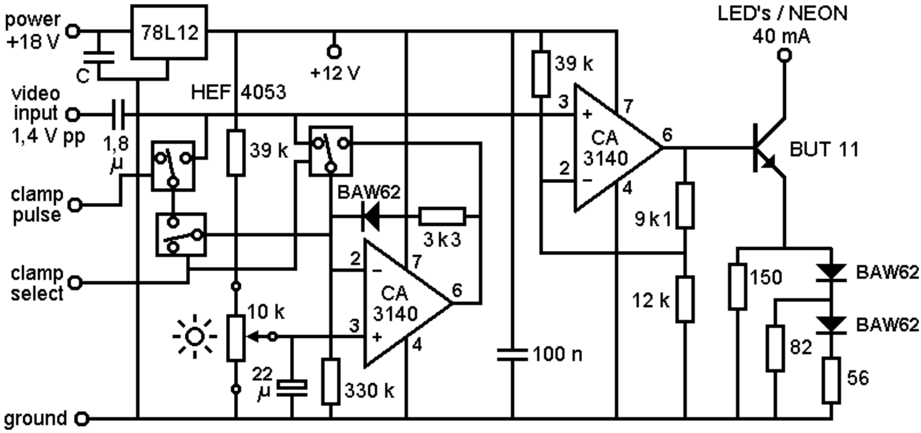




The neon or LED-chain is driven by a high voltage transistor BUT11 that easily withstands hundreds of volts. Other types high voltage transistors should work equally well. Gamma correction is done in the emitter circuit. On the base there is a video voltage present of 2 volts from black to white. Black is at 0.7 volt DC, the cut off voltage of the transistor. The emitter resistor is bridged by two silicon diodes with series resistors. This approximates the parabola curve by means of three straight lines, see the curve at the right. To customise the circuit to meet your own requirements, first calculate the value of a resistor R to obtain a linear working driver. For example, a white current of 40 mA results in a value of 50 ohms (2 volts / 0.04 ampere = 50). The three resistor values are calculated by multiplying by the factors given in the simplified diagram.
A 2x amplifier brings a 1 V black to white video signal to the desired amplitude. The input signal of this amplifier has also negative-going sync pulses of 0.4 volt. It is important that the black level of this video signal is held at a steady DC value of 2 volts. A clamping circuit does this. In this design there are two possible ways of applying clamping. The first method uses an ordinary DC restorer circuit with a diode. It levels the most negative peaks to a voltage that can be set with the aid of the brightness potentiometer. There is a compromise made in the

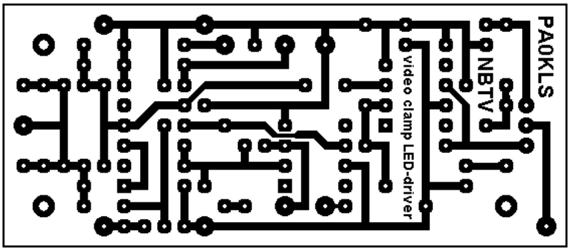
values of the video capacitor of 1.8 µF and the leak resistor of 330 k. If the resistor discharges the capacitor too fast you see "sag" in the video: the picture at the end of a line is darker than at the beginning. If it leaks too slowly your picture shows changes in the reproduction of black after the overall brightness of the scene changes.
The second method employs a no compromise active clamp circuit. It needs so-called clamping pulses, pulses that are active during the low period of the sync. During the clamping pulse an analogue switch connects the right side of the 1,8 µF video capacitor to a fixed voltage. During the following active line the right side of the video capacitor is floating. Now there is no "sag" and no change in the black level. However, these clamping pulses need to be provided. They are produced in the sync separator circuit, as described in the next chapter. An analogue switch selects between the two clamping methods.

Circuit Diagram

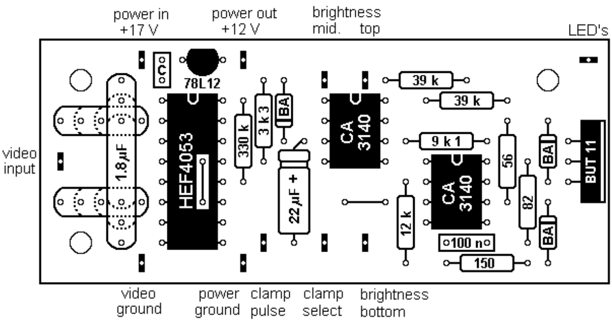


The real circuit diagram appears somewhat more complicated. This mainly because of the switching needed to select between the DC restorer and the active clamp. For the DC restorer the characteristic of the diode is amplified by an op-amp and simulates a perfect diode. For the active clamp circuit the same op-amp is converted into a "follower" circuit for the brightness voltage. All the switching is achieved using a single HEF4053. It is shown in the position in which the switching input line, named clamp select, is low (zero). Thus the perfect diode DC restorer circuit is in operation.
The resistors for the gamma correction in this diagram are calculated for a 40 mA LED or neon lamp white current. Some rounding is done to compensate for the "internal" resistance of the diodes. This is always a few ohms, so rounding to the lower value is preferred. The general purpose silicon diodes BAW62 can be replaced by other types, e.g. 1N4148. The diagram also shows a voltage stabiliser IC of the type 78L12 to get a stable +12 volt. This voltage can be picked off to power the sync separator circuit as well.

Printed Circuit Board

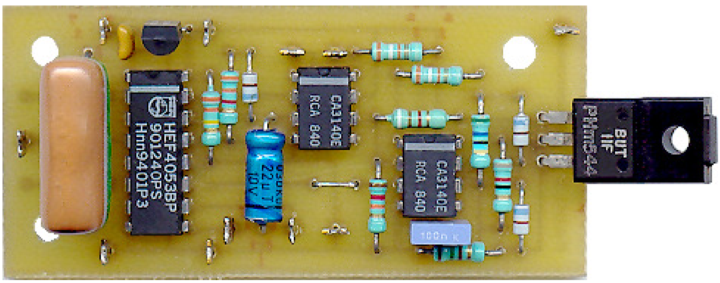


A small printed circuit board for this project was designed. It measures just 3 by 7½ cm. Check our club sales for the availability. They are single sided and very small. When you're going to assemble the board, be aware that there are two wire links to be placed, one of them under the circuit HEF4053. So first solder the link in place before you place the IC.



There are several holes to hold the video capacitor of 1.8 µF. A rather large colour banded polyester capacitor was used in the prototype. Always use a good quality capacitor, never an electrolytic capacitor in this place. You may use a smaller sized 1 µF with 0.82 µF in parallel.

The power input capacitor C is not always needed. To be sure place here a type that fits in the available space and has a value as large as possible, e.g. 100 nF. The output transistor should be mounted on a heat sink. For a first run you can connect the video input directly to the line output of a CD player and run the NBTV discs. Connect the input "clamp select" to ground to select the "perfect diode" DC restorer.



Sync Separator

To use the active clamp you need clamping pulses. The next chapter describes that part of the video processing chain. It generates clamp pulses that can be used as well as a line pulse, and a frame pulse derived from the missing sync pulse. This part also contains a video pre-amplifier making the monitor work on video signals with voltages down to 0.5 volt p.p. A small PCB has also been designed for that circuit.