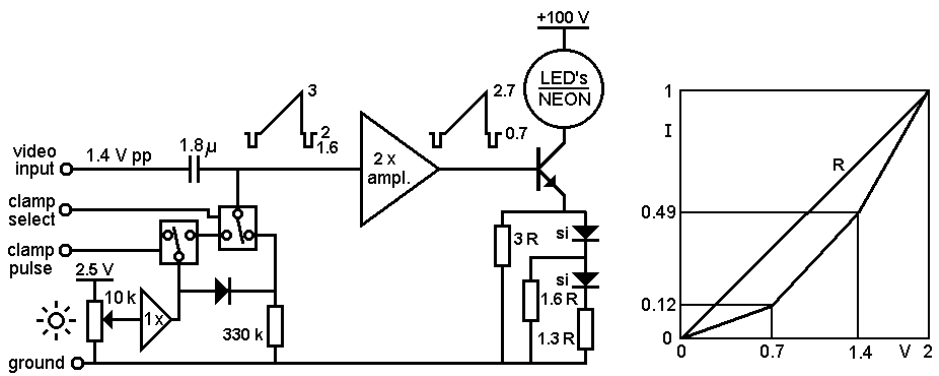
Video amplifier - LED/neon driver

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 will work on signals coming directly from the line output of a CD-player running the club CD's. It features gamma correction for a better display of grey shades.
The amplifier drives a neon lamp as well as a chain of LED's. Connect 40 orange ultra bright LED's in series and the over all voltage is about the same as for a small neon bulb (85 volts). A DC power supply voltage of about 100 volt will do, so in fact there are no changes in circuitry. If you want to change the LED driver to a lower voltage and a higher current the only thing that you should do is to recalculate the resistor values in the gamma correction circuit.

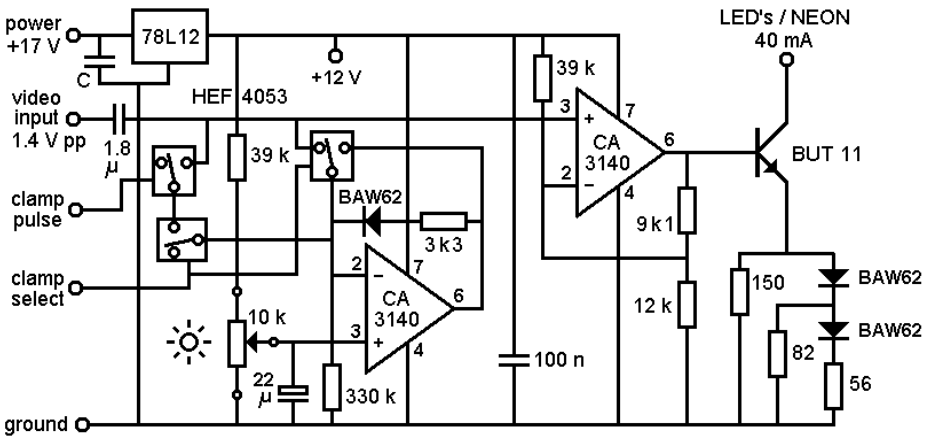
Simplified Diagram



The neon or LED-chain is driven by a high voltage transistor BUT11 that easily withstands the high-voltage. 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 on 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. For your private use: calculate the value of a resistor R that you would use to obtain a linear working driver. I arrived to 50 Ω to get a white current of 40 mA. Then calculate the three resistor values.
A 2x amplifier brings the 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 has a steady DC value of 2 volts. A clamping circuit sees for that. In this design there are two clamping circuits. Firstly an ordinary DC restorer circuit with a diode levels the most negative peaks to a voltage that can be set with the brightness potmeter. There is a compromise made in the values of the video capacitor of 1,8 µF and the leaking resistor of 330 k. If the resistor leaks 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 you see changes in black reproduction during changes in overall brightness.
A much better circuit is an active clamp. If there are so-called clamping pulses available, pulses that are present during the low period of the sync pulse, then an analogue switch connects the right side of the video capacitor to a fixed voltage during the clamping pulse. During the active line the right side of the video capacitor is floating. Now there is no "sag" and no change in the black level. However, you need these clamping pulses that are derived from the sync. An analogue switch selects between the two clamping circuits.

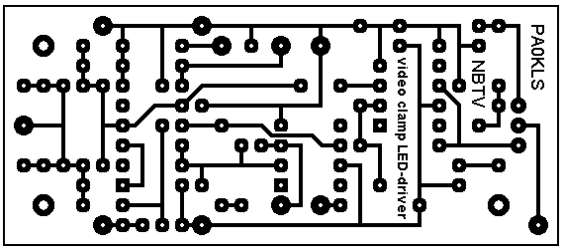
Circuit Diagram

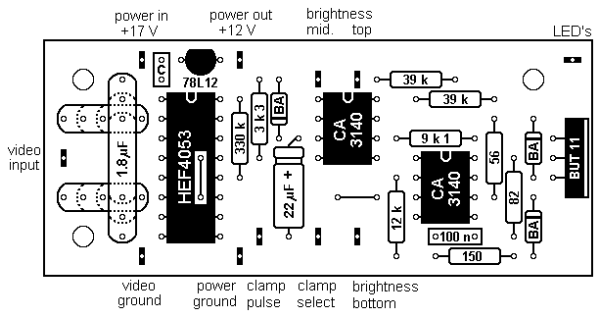


The real circuit diagram looks somewhat more complicated. This is mainly because the diode clamp is made in a different way. The diode characteristic is amplified by the op-amp and forms an almost "perfect" diode. For the active clamp circuit the same op-amp is switched to a "follower" circuit for the brightness voltage. This required a third analogue switch; happily a single HEF4053 contains three switches. The HEF-switches are shown in the position in which the switching input is low (zero).
The resistors for the gamma correction in this diagram are chosen on 40 mA LED 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 to get a perfect stable +12 volt. This voltage can be picked off to power the sync separator circuit.

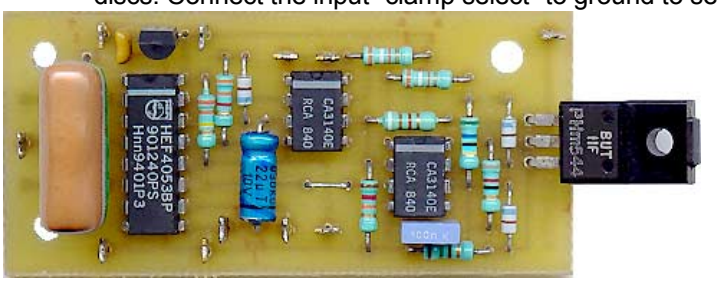
Printed Circuit Board

A small printed circuit board for this project was designed. It measures just 3 by 7½ cm. Check our club sales for the availability. As they are single sided and very small, they are cheap. 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. I used a rather large colour banded polyester capacitor. Always use a capacitor of well known make, never use an electrolytic C in this place. You also can use a smaller size 1 µF cap with a 0,82 µF cap 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 large as value 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 a clamping pulse. The next chapter describes that part of the Nipkow disc monitor video processing chain. It generates clamp pulses that also can be used 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 to work on video signals with voltages down to 0,5 volt p.p. Also for that circuit a small PCB has been designed.