COMPOSITE - TO - TTL ADAPTOR FOR MONOCHROME MONITORS

Among the welcome side-effects of the current invasion of IBM PCs and compatibles are the drastic price cuts for high-resolution, 12 and 14 inch, TTL-compatible monochrome monitors. The circuit described here makes it possible to use such a display in conjunction with a computer that has a composite video output only.

Many owners of popular home computers must at some time have been envious of IBM PC users, because these are in a position to look at text and graphics on a restive, high-resolution, non-glare monitor instead of on a (modified) TV set tuned to channel 36, and barely capable of displaying 80 characters per line. Until recently, however, the cost of a TTL monitor was such that manufacturers of home computers in the lower price ranges did not even consider equipping these with a digital output. The inexpensive adaptor circuit described here should allow many owners of the first generation of home computers to benefit from the advantages offered by the TTL-compatible monitor.

Circuit description

The circuit shown in Fig. 1 effectively splits the CVBS (composite video-blanking-synchronisation) signal applied to the input into three components: horizontal and vertical synchronization pulses, and video. These three signals are then converted to digital level to enable driving the corresponding inputs on the TTL monitor.

The low reference level of the CVBS signal is first set to 0 V by an active clamping circuit around IC_1. Figure 2 shows the voltage levels in a CVBS signal. Note that the amplitude of U_{sync} is usually about one third of that of U_{video}. The switching threshold of comparator IC_2 is set such that only the synchronization pulses can cause the opamp output to go low. The composite sync signal is then fed to XOR gate N_1 and to a two-section R-L-C low-pass filter. Switch S_1 connected to pin 2 of N_1 selects the signal polarity at the H-sync output. The presence there of V-sync pulses has no consequence for the TLL monitor. The V-sync pulses obtained after filtering in the low-pass can be inverted, if necessary, by closing S_2. Inversion is probably not necessary for most types of monitor, but users are well advised to consult the relevant manual in case of doubt.

A fast comparator, based around opamp Type 733 (IC_3) and FETs T_1-T_2, extracts the video component from the CVBS input signal. It should be noted that the attainable contrast ratio is mainly determined by the speed of the opamp, so that the circuit does not work correctly if IC_3 is replaced by a slower type. The toggle point of IC_3 is set to the average video level by P_2. Impedance conversion between the opamp and the digital video input of the monitor is achieved with T_4 and T_5, the latter functioning as an adjustable zener diode.

Construction, setting up and application

The adaptor is constructed on the printed circuit board shown in Fig. 3. The two inductors are preferably ferrite-encapsulated radial types from Toko. The completed unit can be installed in the monitor, which usually has room to spare inside. This has the advantage that the adaptor can be fed from the existing power supply, ensuring correct interface levels (check the specification of the monitor in this respect). As shown in the circuit diagram, the adaptor is uncritical of the supply voltage level, as long as this is between 5 and 12 V, and well regulated.

An oscilloscope enables the unit to be aligned quickly. With reference to Figs. 2 and 3, measure the levels $\frac{1}{2}U_{sync}$ (x), and $U_{sync}+\frac{1}{2}U_{video}$ (y), and set these voltages as the toggle levels for IC_2 (P_1) and IC_3 (P_2) respectively. Adjust P_3 for optimum picture resolution and stability. When an oscilloscope is not available, set P_2 and P_3 to the centre of

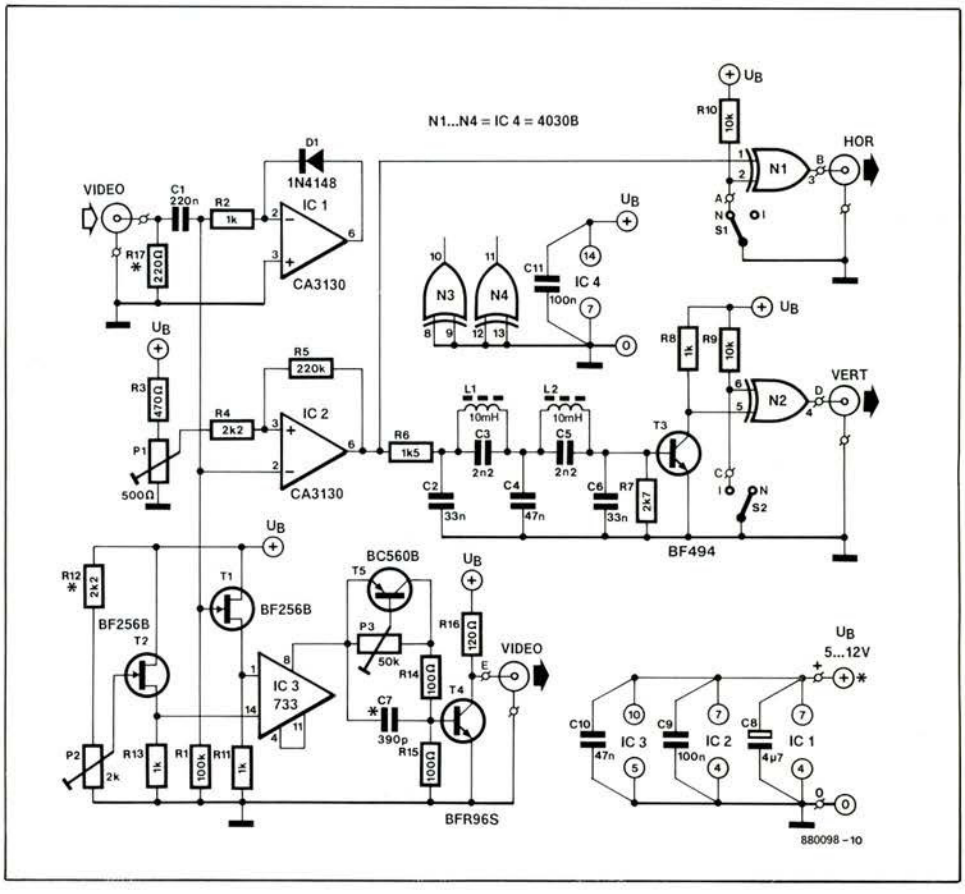


Fig. 1. Circuit diagram of the composite-to-TLL converter.

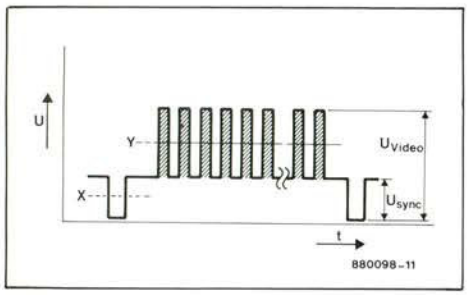


Fig. 2. Toggle level for the sync comparator (X) and for the video comparator (Y).

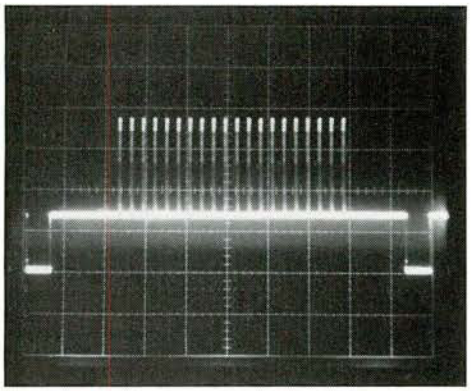
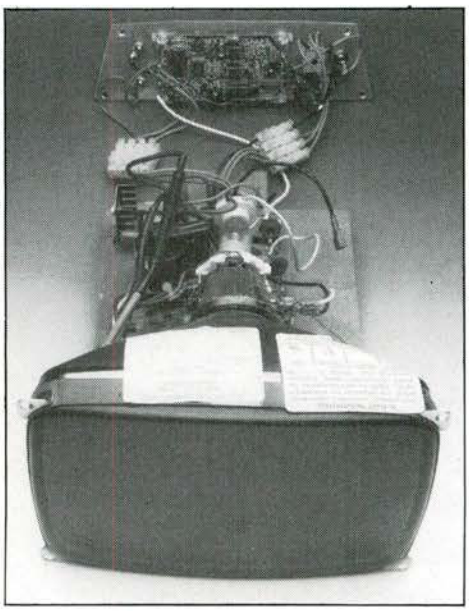
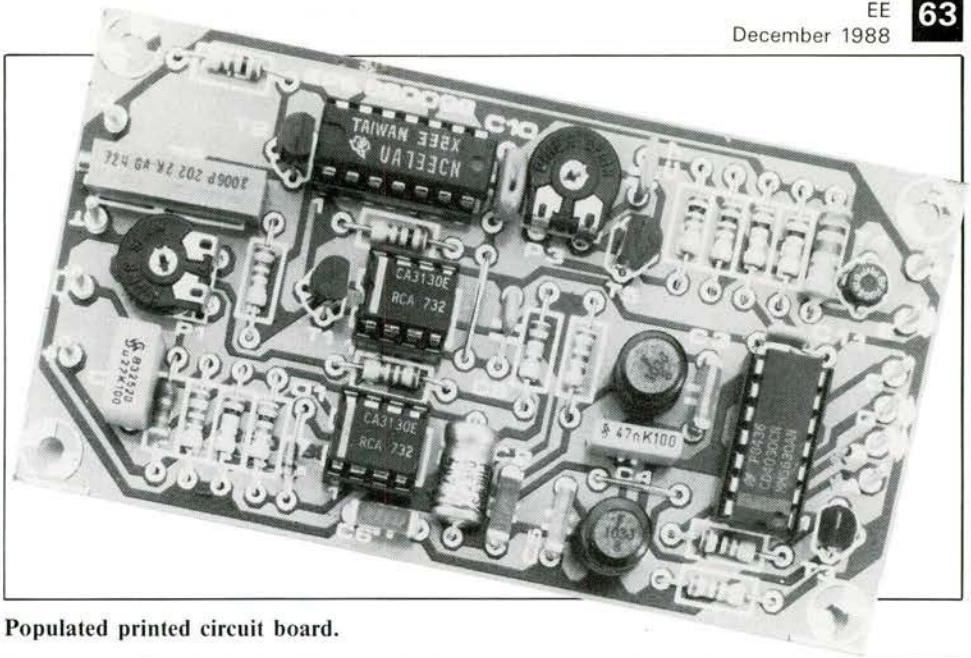


Fig. 3. Oscilloscope display of one line of text in a monochrome CVBS signal supplied by a BBC model B computer.

their travel, and turn the wiper of P_1 to ground. Apply the input signal, and carefully advance P_1 until the picture synchronizes. Then adjust the other two presets for optimum picture quality, first P_2 and then P_3.

The circuit is dimensioned to work with input video levels between 1 V_{pp} and 4 V_{pp}. The value of R_{17} may have to be increased, or the resistor may have to omitted, to ensure correct operation with home computers whose output level is lower than 1 V_{pp}. Signal levels exceeding 4 V_{pp} can be accomodated by lowering the value of R_{12}. Capacitor C_7, finally, also allows some experimenting because it may not be required unless a very high resolution monitor (>80 characters per line) is being used.





Populated printed circuit board.

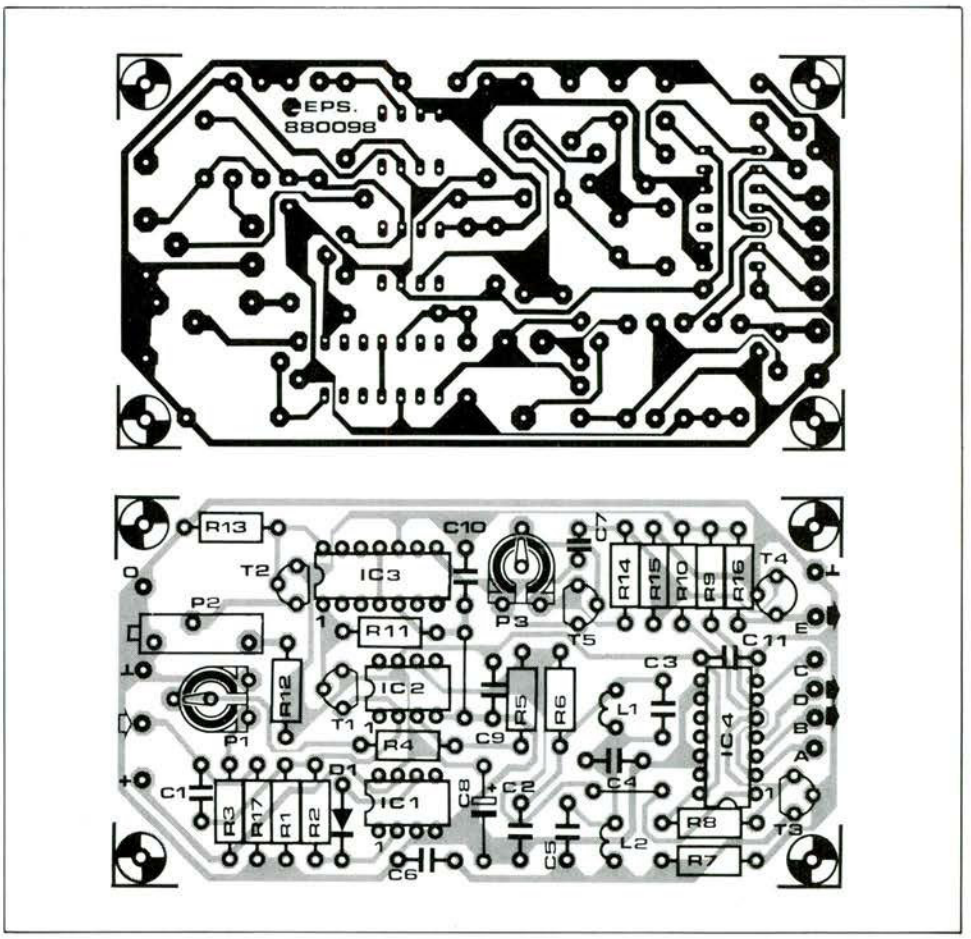


Fig. 4. Printed circuit board for the adaptor.

Parts list

Resistors (±5%):
R_1 = 100K
R_2;R_8;R_{11};R_{13} = 1K0
R_3 = 470R
R_4;R_{12} = 2K2
R_5 = 220K
R_6 = 1K5
R_7 = 2K7
R_9;R_{10} = 10K
R_{14};R_{15} = 100R
R_{16} = 120R
R_{17} = 220R
P_1 = 500R preset H
P_2 = 2K or 2K5 multiturn preset
P_3 = 50K preset H

Capacitors:
C_1 = 220n
C_2;C_6 = 33n
C_3;C_5 = 2n2
C_4;C_{10} = 47n
C_7 = 390p
C_8 = 4μ7; 16 V
C_9;C_{11} = 100n

Semiconductors:
D_1 = 1N4148
T_1;T_2 = BF256B
T_3 = BF494
T_4 = BFR96S (listed by Bonex Ltd.)
T_5 = BC560B
IC_1;IC_2 = CA3130
IC_3 = uA733 or LM733
IC_4 = CD4030B

Miscellaneous:
L_1;L_2 = 10mH radial inductor, e.g. Toko Type 181LY-103 (Cirkit stock no. 34-10302).
S_1;S_2 = miniature SPST switch.
PCB Type 880098 (see Readers Services page).