Video to S-VHS Converter

From composite (CVBS) to C/Y

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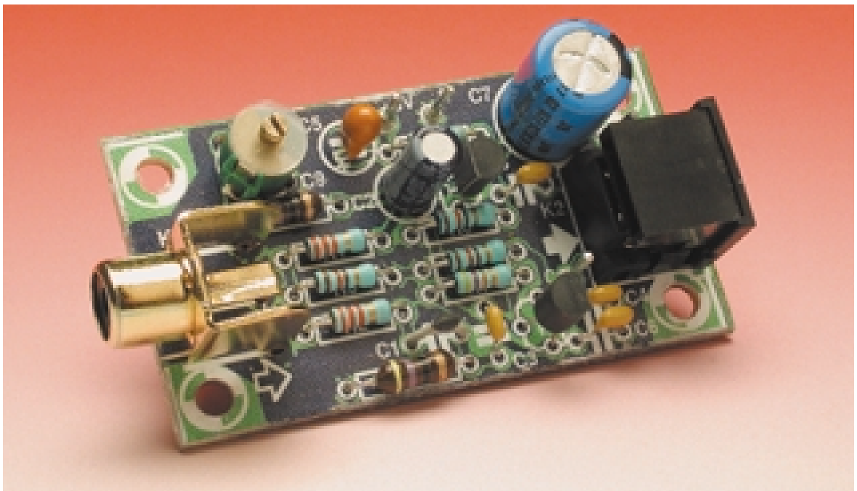
Having problems connecting standard video to your S-VHS equipment? You need this neat circuit. It takes a composite video signal and converts it into the C/Y input signals used by S-VHS. To simplify construction a PCB design is supplied.



A standard video signal (also known as Composite Video Baseband Signal or CVBS) contains the black/white and picture synchronisation information together with the colour information in one signal. S-video signals (also known as Y/C) are slightly different in that these two parts of the picture signal are supplied as separate signals. Y is the luminance signal containing both black/white and sync information while C is the chrominance signal containing colour information.

Equipment using Y/C signals has the advantage of better picture resolution (greater bandwidth), less cross-colour interference and fewer filters for the signals to squeeze through.

The circuit described here allows a standard CVBS signal to be connected to the input of S-VHS equipment. It will however not improve picture quality. The circuit requires a +5 V power source supplying approximately 50 mA.

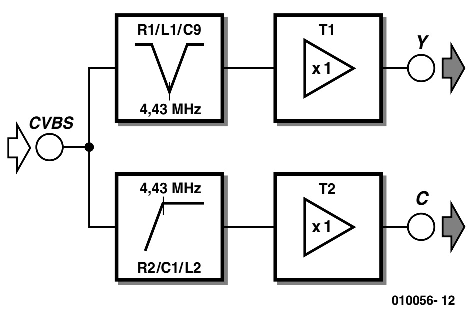


Figure 1. Block diagram showing separation of the CVBS signal into its Y and C components.

The bandwidth of a composite video signal extends from 50 Hz up 5 MHz. Colour information is mixed into the signal on a sub-carrier at 4.43 MHz with a bandwidth of –1.2 to +0.6 MHz. The job of our circuit is to try to cleanly separate the Y and C signals from each other (a standard TV needs to be able to do this as well). The method chosen here is one of the simplest. A notch (or bandstop) filter tuned to the sub-carrier frequency is used to remove the C from the Y information. A disadvantage of this method is that the picture information suffers a bandwidth reduction from 5 MHz to around 4 MHz thereby giving poorer picture resolution. The C signal is produced by passing the composite signal through a 4.43 MHz high-pass filter to remove most of the lower frequency Y components however some Y remains and causes visible cross-colour effects on the picture.

Modern TVs achieve this Y/C separation by using a comb filter, and a delay line. The advantage is a greater bandwidth of the Y signal and no cross-colour effects. S-VHS video recorders also use this tech-

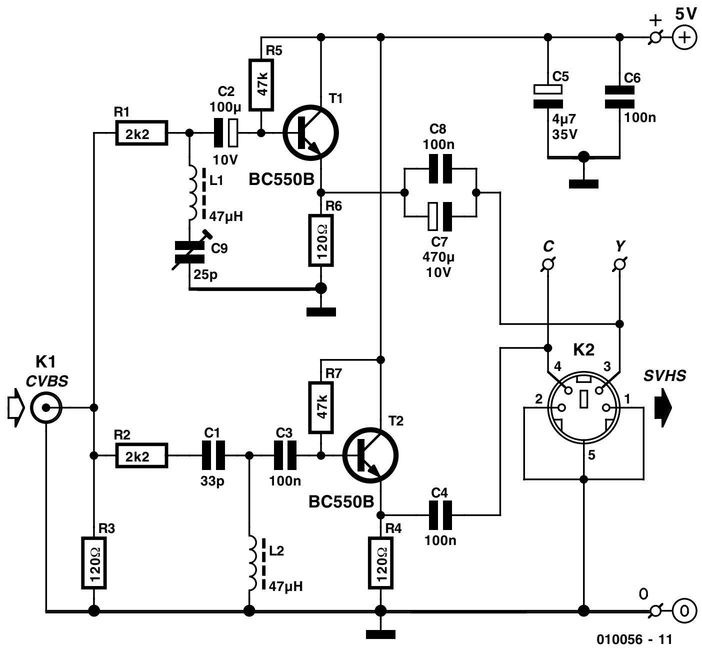


Figure 2. Circuit diagram.

nique so that the Y component of the recorded signal will have a better bandwidth.

The circuit block diagram is shown in **Figure 1**. The C part of the signal is cleanly filtered out from the composite signal using an RLC high pass filter circuit while the Y part uses an RLC notch or bandstop filter to remove the C information. Transistors T1 and T2 act as buffers to produce low impedance Y and C outputs.

The circuit diagram shown in **Figure 2** closely follows the block diagram layout. R2, C1 and L2 form a high pass filter to recover the C signal. The filter output is coupled via C3 to the base of transistor T2. This transistor is a common-emitter configuration and buffers the filter while providing a low impedance output via C4 to the S-VHS connector.

The bandstop filter used in the Y path is made up of R1, L1 and C9. L1 is again a standard 47 µH fixed inductor while C9 is an adjustable trimmer, this allows some optimisation of the picture. The Y signal contains frequency components going down to 50 Hz so the signal coupling capacitors C2 and C7 need to have a larger value than in the C signal path, otherwise low frequency parts of the signal would be attenuated. The ac-coupled low impedance signals C and Y are output on pins 4 and 3 respectively of the S-VHS connector K2. Two supply decoupling capacitors C5 and C6 complete the circuit.

The input and output impedance of this circuit deviate from the optimum value but were chosen to ensure that the output signal levels are correct. At 75 Ω the signal levels should be 0.3 V_{pp} (burst-amplitude) for C and 1.0 V_{pp} for Y.

The layout of the PCB is shown in **Figure 3**. As in all RF circuits it is important to keep the component leads as short as possible when fitting them to the PCB. An earth plane surrounds the tracks so a little extra care is required when soldering to ensure that no solder bridges are formed. In place of a genuine Hosiden S-VHS socket we have specified a standard mini DIN socket for PCB mounting. It will happily accept a Hosiden plug as long as the small plastic stop pins are first removed from the plug.

During set-up, trimmer C9 should be adjusted to produce minimum Moiré (colour patterning) effect on the picture. The circuit was successfully tested on many different S-VHS inputs. Generally the bandstop filter in the Y path was necessary but with a WinTV card it did not make any noticeable difference if the filter was in or out. In this case you could simply bypass the Y circuitry and just use the composite video signal as the Y signal.

Finally a reality check, as mentioned before, the quality of the S-VHS compatible output signal generated here cannot be any better than the composite video input signal. To get real S-VHS picture quality, you do of course need a 'genuine' S-VHS signal source connected directly to the Y/C input of the monitor, TV or recorder.

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COMPONENTS LIST

Resistors:
R1,R2 = 2kΩ2
R3,R4,R6 = 120Ω
R5,R7 = 47kΩ

Capacitors:
C1 = 33pF
C2 = 100µF 10V radial
C3,C4,C6,C8 = 100nF ceramic
C5 = 4µF7 35V tantalum bead
C7 = 470µF 10V radial
C9 = 25pF trimmer capacitor (3-25 p)

Inductors:
L1,L2 = 47µH

Semiconductors:
T1,T2 = BC550B

Miscellaneous:
K1 = Cinch socket, PCB mount, e.g., T-709G (Monacor/Monarch)
K2 = 6-way Mini-DIN socket, PCB mount, angled pins

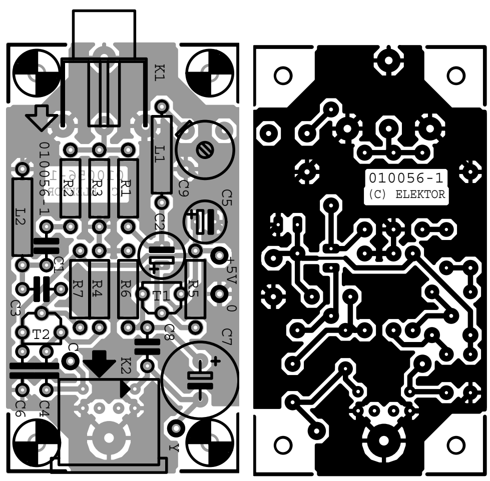

Figure 3. PCB layout. The groundplane is typical of an RF layout (board not available ready-made).