Figure 11. Nulling Residual Color in Black

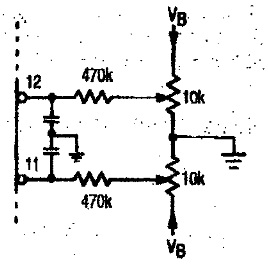
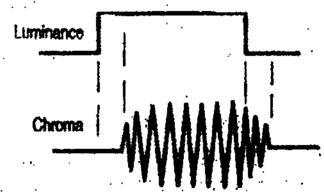


Figure 12. Delay of Chroma Information



The Chroma Coupling Circuits

With the exception of S–VHS equipped monitors and receivers, it is generally true that most monitors and receivers have color IF 6.0 dB bandwidths limited to approximately ±0.5 MHz. It is therefore recommended that the encoder circuit should also limit the chroma bandwidth to approximately ±0.5 MHz through insertion of a bandpass circuit between Pin 13 and Pin 10. However, if S–VHS operation is desired, a coupling circuit which outputs the composite chroma directly for connection to a S–VHS terminal is given in the S–VHS application (see Figure 19).

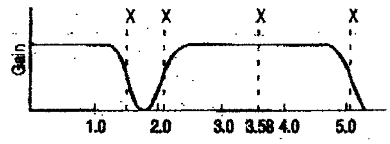
For proper color level in the video output, a ±0.5 MHz bandwidth and a midband insertion loss of 3.0 dB is desired. The bandpass circuit shown in Figure 7, using the TOKO fixed tuned transformer, couples Pin 10 to Pin 13 and gives this result. However, this circuit introduces about 350 ns of delay to the chroma information (see Figure 13). This must be accounted for in the luminance path.

A 350 ns delay results in a visible displacement of the color and black and white information on the final display. The solution is to place a delay line in the luminance path from Pins 6 to 8, to realign the two components. A normal TV receiver delay line can be used. These delay lines are usually of 1.0 kΩ to 1.5 kΩ characteristic impedance, and the resistors at Pins 6 and 8 should be selected accordingly. A very compact, lumped constant delay line is available from TDK (see Figure 25 for specifications). Some types of delay lines have very low impedances (approx. 100 Ω) and should not be used, due to drive and power dissipation requirements.

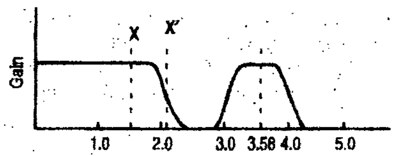
In the event of very low resolution RGB, the transformer and the delay line may be omitted from the circuit. Very low resolution for the MC1377 can be considered RGB information of less than 1.5 MHz. However, in this situation, a bandwidth reduction scheme is still recommended due to the response of most receivers.

Figure 14(a) shows the output of the MC1377 with low resolution RGB inputs. If no bandwidth reduction is employed then a monitor or receiver with frequency response shown in Figure 14(b), which is fairly typical of non–comb filtered monitors and receivers, will detect an incorrect luma sideband at X′. This will result in cross–talk in the form of chroma information in the luma channel. To avoid this situation, a simpler bandpass circuit as shown in Figure 15(a), can be used.

Figure 13. MC1377 Output with Low Resolution RGB Inputs



(a) Encoder Output with Low Resolution Inputs and No Bandpass Transformer



(b) Standard Receiver Response

A final option is shown in Figure 15(b). This circuit provides very little bandwidth reduction, but enough to remove the chroma to luma feedthrough, with essentially no delay. There is, however, about a 9 dB insertion loss from this network.

It will be left to the designer to decide which, if any, compromises are acceptable. Color bars viewed on a good monitor can be used to judge acceptability of step luminance/chrominance alignment and step edge transients, but signals containing the finest detail to be encountered in the system must also be examined before settling on a compromise.

The Output Stage

The output amplifier normally produces about 2.0 V_{pp} and is intended to be loaded with 150 Ω as shown in Figure 16. This provides about 1.0 V_{pp} into 75 Ω, an industry standard level (RS–343). In some cases, the input to the monitor may be through a large coupling capacitor. If so, it is necessary to connect a 150 Ω resistor from Pin 9 to ground to provide a low impedance path to discharge the capacitor. The nominal average voltage at Pin 9 is over 4.0 V. The 150 Ω dc load causes the current supply to rise another 30 mA (to approximately 60 mA total into Pin 14). Under this (normal) condition the total device dissipation is about 600 mW. The calculated worst case die temperature rise is 60°C, but the typical device in a test socket is only slightly warm to the touch at room temperature. The solid copper 20–pin lead frame in a printed circuit board will be even more effectively cooled.

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