One Transistor Enables Clean HDTV and NTSC Video Sync Separation

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The growing popularity and availability of HDTV is creating a small revolution in the video industry. New video systems must be capable of handling the standard NTSC (National Television System Committee) composite signal as well as high definition signals. Since low cost and low power concerns drive system designers to find the simplest solutions, this article describes a one transistor network that enables a single video sync separator to operate for both HDTV and NTSC systems.

In the sample NTSC signal shown in Figure 1, the color burst and color subcarriers are identified. A "slice level" is drawn half-way down the drop for horizontal synchronization. Variations in color burst or dark blues within the subcarrier can dip below the slice level, causing false sync pulses in addition to the 15kHz horizontal sync signal. With HD (High Definition) signals (Figure 2), the color information is carried separately, so there is no color burst or subcarrier to cause false sync pulses. However, note that the horizontal sync pulse is shorter and higher frequency (20kHz).

It is advantageous if a single sync separator will operate with both HD and NTSC signals. Since false triggers can occur with NTSC signals, a filter can be added in the sync separator path to reduce the height of the color burst and subcarrier signals. This filter cannot be included during HD detection, though, since its shorter sync pulse would also be attenuated, causing missed triggers.

The ISL59885 is a sync separator which features both HD and NTSC detection. An output, labeled HD, is provided which responds to the type of input - high for NTSC and low for HD. This external pin can be used to insert a low-pass filter into the sync separator path preventing false sync pulses in composite video. The circuit is shown in Figure 3. When composite signal (NTSC/PAL) is detected, the filter is enabled by applying a logic high to the base of the transistor. When component signal (HD) is detected, the filter is disabled by having the HD pin at a logic low state. Although the transistor is disabled during HD, a low pass filter is still present to filter out any noise present at the input.

The cut-off frequency for the filter is $1/2\pi(R_F)(C_{FT})$ = 2.79MHz, where C_{FT} is the total capacitance of C_F in parallel with $C_{F(HD)}$, shown in Figure 3. Computing C_{FT} with R_F = 100Ω and C_{FT} = 570pF, the 3.58MHz color burst, for example, is attenuated to 60% of its original 190mV size (Figure 4) while passing 15kHz sync signals without appreciable attenuation. This is enough headroom to prevent false trigger since the slice level is 70mV and the new color burst amplitude is 116mV (Figure 5). Note that the lowest color subcarrier level in this example was also attenuated from -120mV to -8mV. If we use a smaller CF, the color burst will attenuate less. Ideally we want to maximize CF to attenuate more of the signal, but the cost of a bigger capacitor causes an increase in the propagation delay and rounded falling edges on the sync pulses.

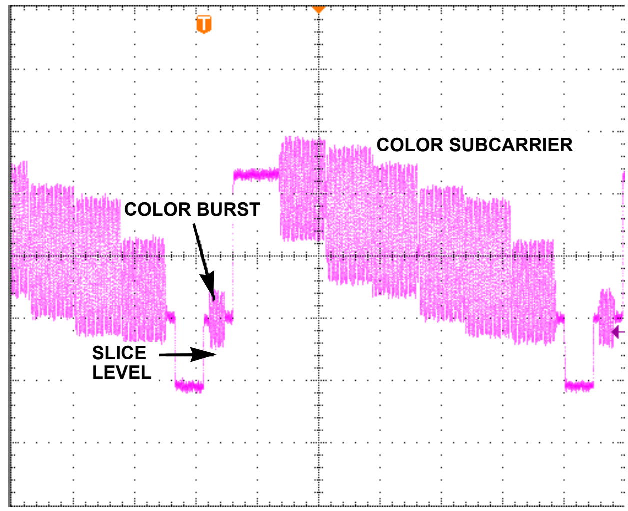

FIGURE 1. NTSC SIGNAL

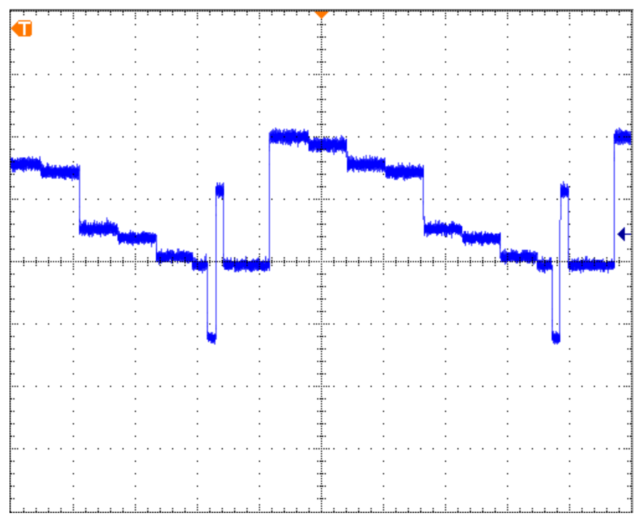

FIGURE 2. HD SIGNAL

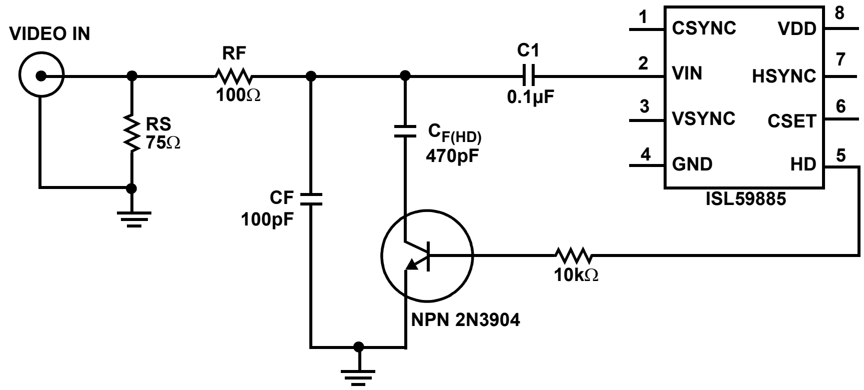

FIGURE 3. FILTER CIRCUIT ALLOWING RELIABLE SYNC DETECTION OF HD AND NTSC VIDEO

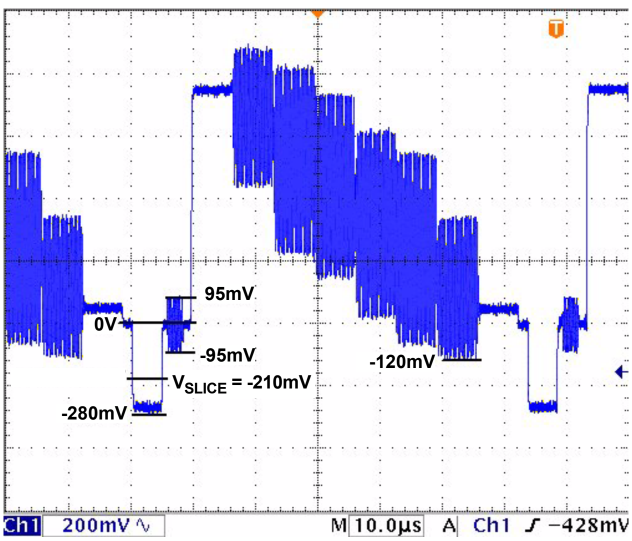

FIGURE 4. VOLTAGE LEVELS OF NTSC VIDEO

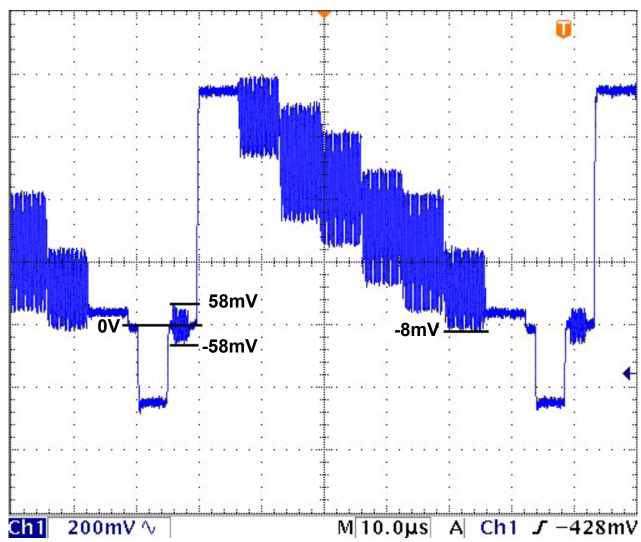

FIGURE 5. ATTENUATED INPUT OF NTSC SIGNAL

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