ZLAN-268

Zarlink Analog Switches for Low Bandwidth Video Surveillance System Application

Application Note

June 2010

Contents

1.0 Low Bandwidth Video Basics

Formats - There are many different kinds of video signal for analog video camera. In the United States and Japan, the NTSC (National Television System Committee) format is used. In Europe, the PAL (Phase Alternating Line) format is common. Although the 2 formats are generally not compatible with the others, they all utilize the same basic scanning system and represent colour with a type of phase modulation, they differ in specific scanning frequencies, number of scan lines and colour modulation techniques. The Highest frequency for NTSC signal is 4.2 MHz and for PAL is 5.5 MHz.

Interfaces - There are three basic levels of base-band signal interfaces. In order of increasing quality, they are composite (or CVBS), which uses one wire pair; Y/C (or S-video), which uses two wire pairs; and component, which uses three wire pairs. Each wire pair consists of a signal and a ground. These three interfaces differ in their level of information combination (or decoding). More encoding typically degrades the quality but allow the signal to be carried on fewer wires. Component has the least amount of encoding and composite the most.

Composite/CVBS Interface - Composite signals are the most common used analog video interface. Composite is also referred to as CVBS, which stands for color, video, blanking and sync, or composite video base-band signal. It combines the brightness information (luma), the colour information (chroma) and the synchronizing signal on just one cable.

Y/C (or S-video) Interface - The Y/C signal is a signal with less encoding. Brightness (luma), which is the Y signal and the colour (Chroma), the C signal are carried on two separate sets of wires. The term “S-video” stands for “separate video” and sometimes is used to refer to a Y/C signal.

Component Interface - Component signal interfaces are the highest performance, because they have the least encoding. The signals exist in a nearly native format. They utilize three pairs of wires that are typically in either luma (Y) and two-colour-difference-signals format or a red, green, blue (RGB) format. RGB formats are almost used in television applications. The Y signal contains the brightness (luma) and synchronizing information and the colour-difference signals contain the red (R) minus the Y signal and the (B) minus the Y signal.

Black and white signal levels – Historically, RS-170 was the original black and white video standard. The DC levels for various portions of the signal are shown in Figure 1. White level to black level was defined to be 100 IRE units for the active video portion, and white to sync tip was therefore 140 IRE units. If the signal was attenuated, the ratio of white to black and white to sync tip remained constant; whether the signal was attenuated or amplified, the value of the white to sync tip signal was 140 IRE units.

Today’s composite video base-band signal (CVBS) is a derivative of the RS-170 with white to sync tip normally set to 1.0 V (white at 0.714 V, blank at 0 V, and sync at -0.286 V). This could be considered as an RS-170 signal attenuated by 71%, as all IRE values still hold. The Y/C (S-video) and component video fit bandwidth reduced colour information into essentially the same base-band signal and hence the DC levels are the same.

By convention, the normal impedance for video cables is 75 ohm. RG-59/RG-6 are the standard cables for interconnecting video devices.

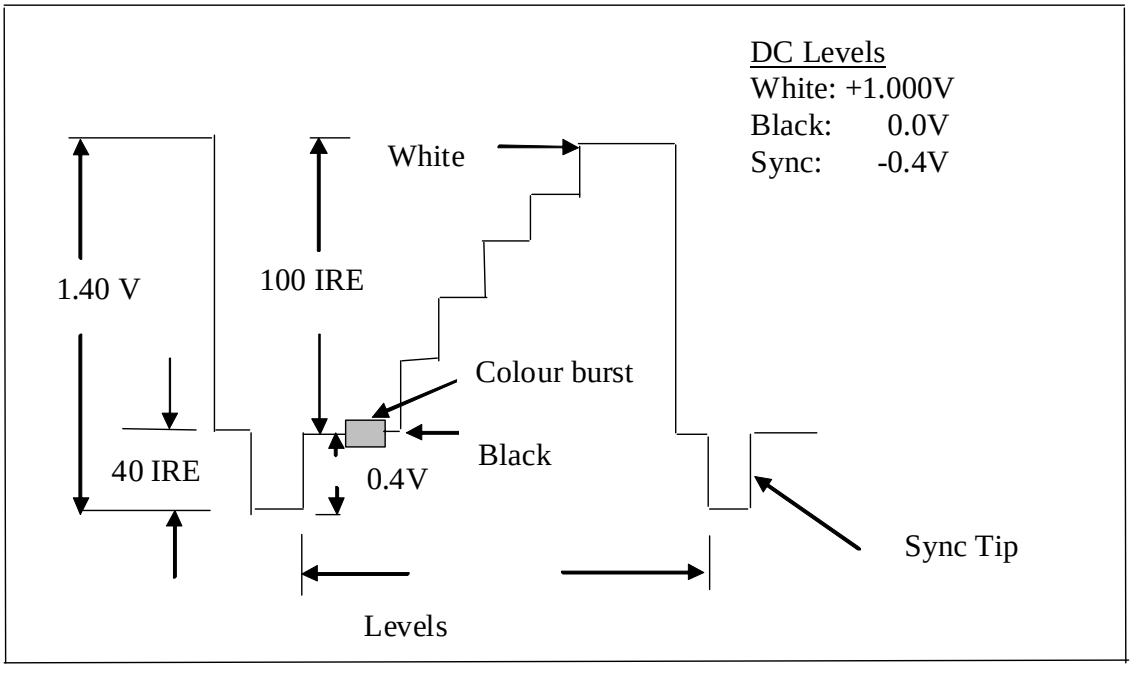

Figure 1 - Black-and-White Signal DC

2.0 Switching CVBS video using Analog Switches

The bandwidth of CVBS signals is limited to <6.5 MHz for all systems. Because of the driving point impedance is low and bandwidth is limiting, most analog switches today can easily handle the task of switching CVBS video. The signal is below ground and the designer may use capacitive coupling and then clamp the signal for black level. If care is not taken, sync tip may be lost along with colour burst reference. By convention, the 1.0 V signal may vary by +/- 6 db, therefore this signal may be as large as 2.0 Vp-p, with the sync tip approximately at -600 mV. The designer may choose an amplifier with +/- 5.0 V supplies biased up the switches to prevent problem. If the signal is to be passed on again to another CBS input then the designer will almost would use the +/- supply method. If the signal remains on the same board and is used for internal display, then the cheaper bias scheme may be used.

Figure 2 shows an Analog Switch in a 2 to 1 video switch with buffered output. The op-amp is set at gain of 6 dB. A series 75 R resistor is added to properly match the impedance. The video sources on the input sides are terminated with a 95 R. A 300 R is used to terminate the analog switch output and together with the 95 R would present almost a perfect match to 75 R.

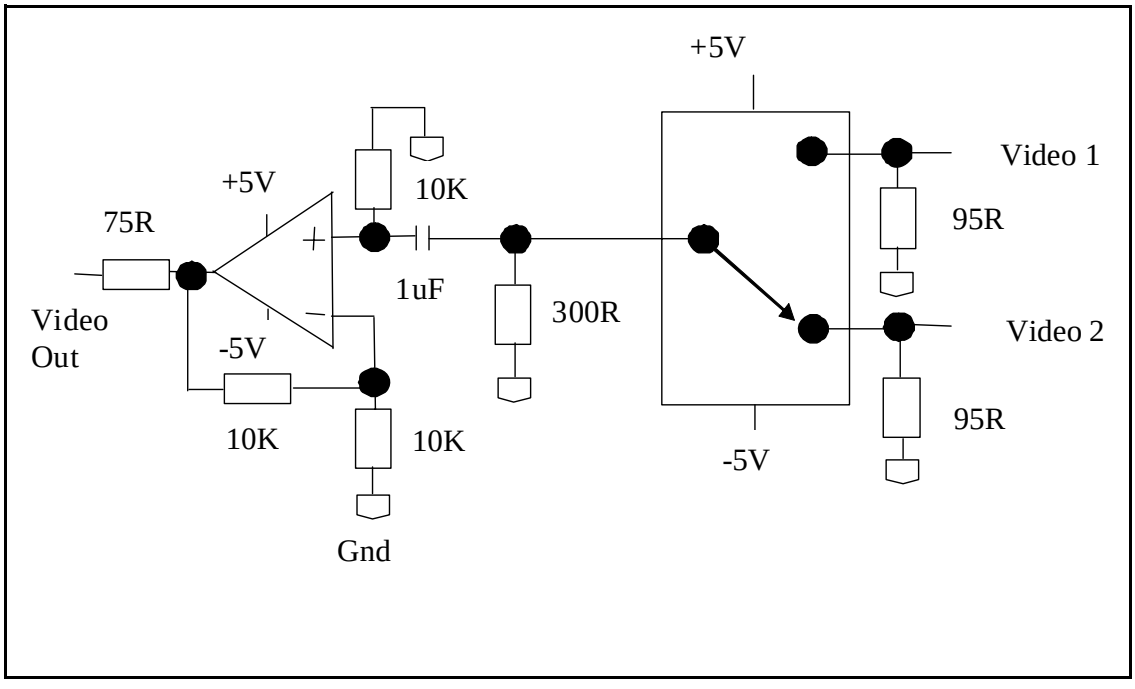

Figure 2 - Simple 2 to 1 CVBS Video Switcher

Figure 2 can also be used for s-video with two channels (two sets of switches and buffers). For component video three sets of switches and buffers should be used.

3.0 Video Surveillance System using Zarlink Analog Switches

Figure 3 shows a typical Operating Circuit of a video surveillance system using Zarlink analog cross-point switches. Analog cross-point switches allow multiple video sources switched to multiple output devices, e.g., video monitor, video recorder etc. External video amplifiers are required as the input buffers and output buffers to drive the video loads.

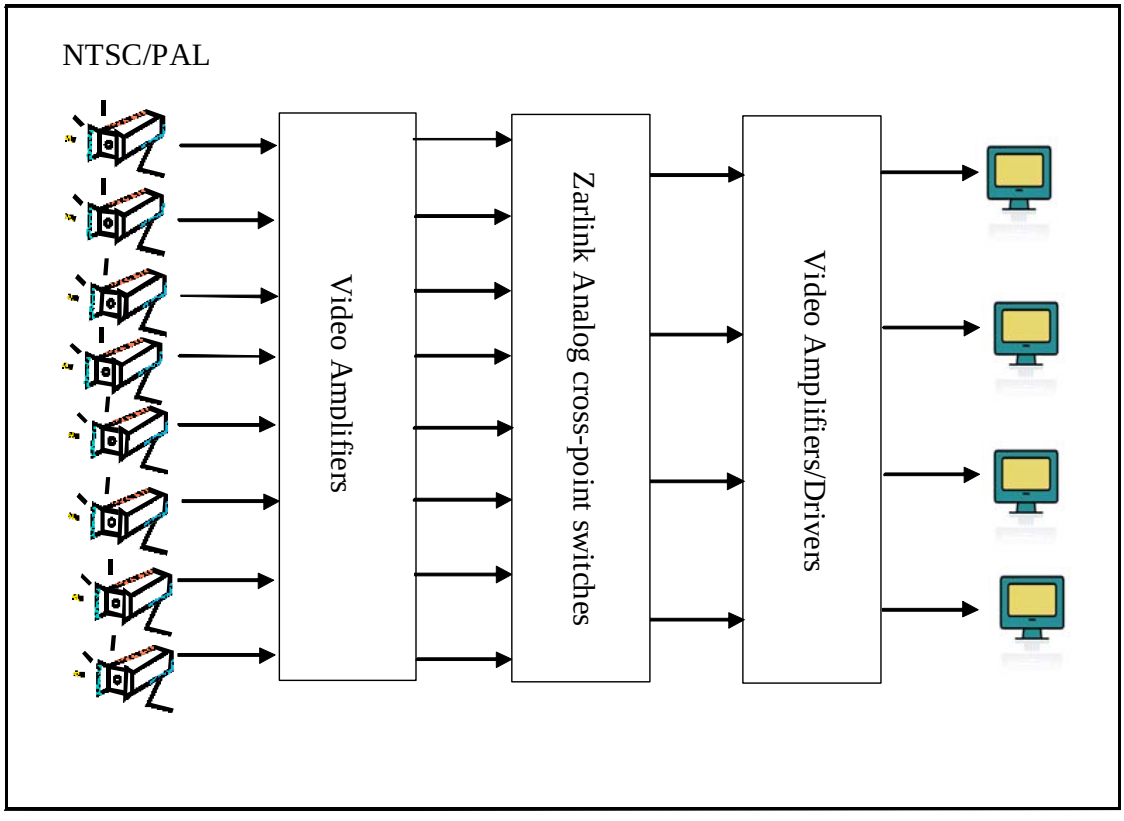

Figure 3 - Typical Video Surveillance Systems

Figure 4 shows a video switch matrix using the Zarlink MT8816 8x 16 analog switch array. CLC2005 dual video amplifiers from Cadeka microcircuits are used for the input buffers and the output drivers. A single channel video signal circuit is shown for a single 5 V supply.

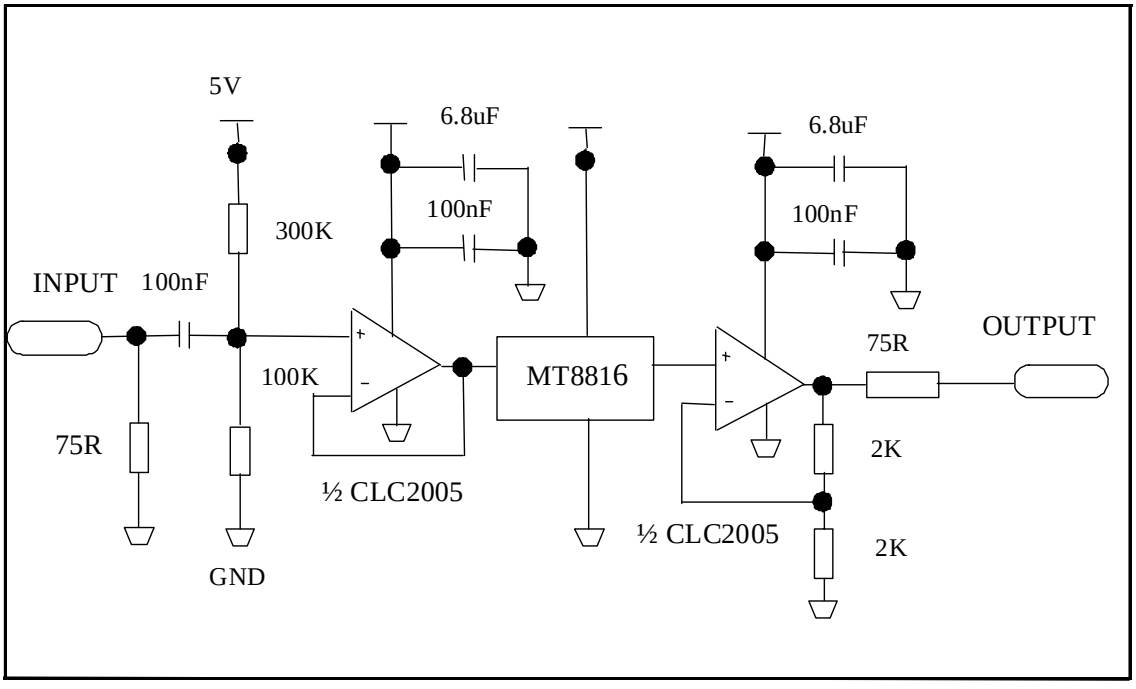

Figure 4 - Input to Output Circuit with Buffers

The CLC2005 buffers the inputs of the MT8816 and provides gain and drive capability for each MT8816 output. Each channel of the CLC2005 can drive three video loads, allowing for increased system capability. The MT8816 offers designers ease-of-use and flexibility by providing eight inputs that can be switched to any of the 16 outputs, or 16 inputs that can be switched to any of the eight outputs. For full scale video, the reference design offers -3 decibels (dB) bandwidth of 35 megahertz (MHz), differential gain/phase of 0.16%/0.33°, and signal-to-noise ratio better than 90 dB.

4.0 Conclusion

With the cost of security camera going down, adding a surveillance system for retail store, office or home is becoming more practical all the time. However, one might be dismayed at the thought of having to buy a monitor for every camera that is installed.

Analog Switch Array from Zarlink semiconductor including the MT8816 meets all the application requirements for low bandwidth analog video switching, when used together with any readily available video amplifiers from Cadeka microcircuits could provide a practical and cost effective solutions for a Low Bandwidth Video Surveillance System.

For more information about all Zarlink products visit our Web Site at

www.zarlink.com