Interface Video Signal Using Pericom Video Switches

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Introduction

Pericom PI3Vxx and PI5Vxx families are wide-bandwidth Video Switches specifically designed and characterized for analog video signal applications, including the component video signals of Ypbpr, YUV, YIQ, Y/R-Y/B-Y, RGB, and the composite video signals such as NTSC, PAL, SECAM etc.

Because of the low on-resistance and on-capacitance, the PI3Vxx and PI5Vxx families have high bandwidth. For example, the insertion loss (bandwidth) is -3.22db at 1Ghz (figure 2) for PI3V520 and is -3.39db at 570Mhz (figure 3) for PI5V330S.

The PI3Vxx and PI5Vxx families also have good R-on flatness, which is an important analog characteristic for video signals that request minimum distortion due to the critical color and picture quality request. The low crosstalk of the PI3Vxx and PI5Vxx family will ensure the high quality display for the high definition video signals.

The PI3Vxx and PI5Vxx families are the NMOS switches. Therefore, when the Vdd power is off, the input channels of these switches will be high impedance. Thus, these video switches are hot swappable to fulfill the TV video signal switching applications.

The excellent performance and low cost of the PI3Vxx and PI5Vxx families provide an optimum cost-performance solution to high volume video applications. Many major manufacturers are using the PI3Vxx and PI5Vxx families for variety applications, such as projection TV, LCD TV, FPD, PDP and HDTV.

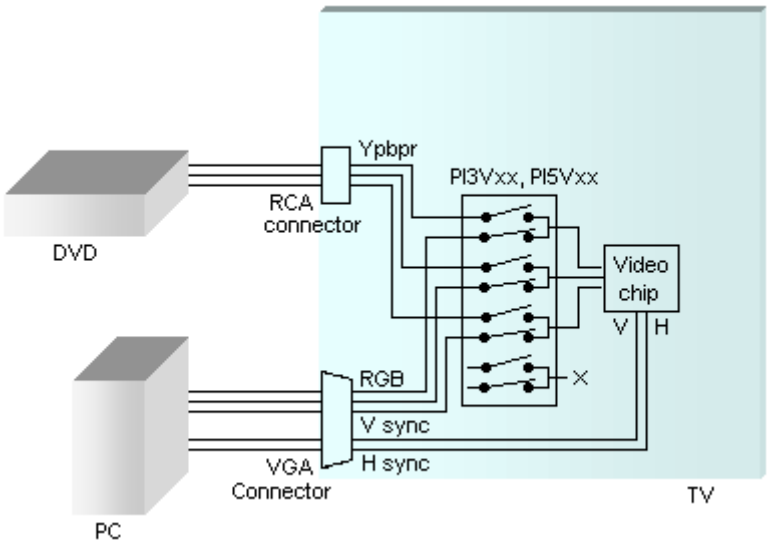

Figure 1: Typical Application

Figure 1 shows the typical application using the Pericom video switches. The video signals from the DVD can be the component video signals of Ypbpr, YUV, YIQ, Y/R-Y/B-Y, RGB, or the composite video signals such as NTSC, PAL, SECAM etc.

The VGA signals from the PC include the RGB (red, green, blue) analog components with separate horizontal and vertical synchronous signals.

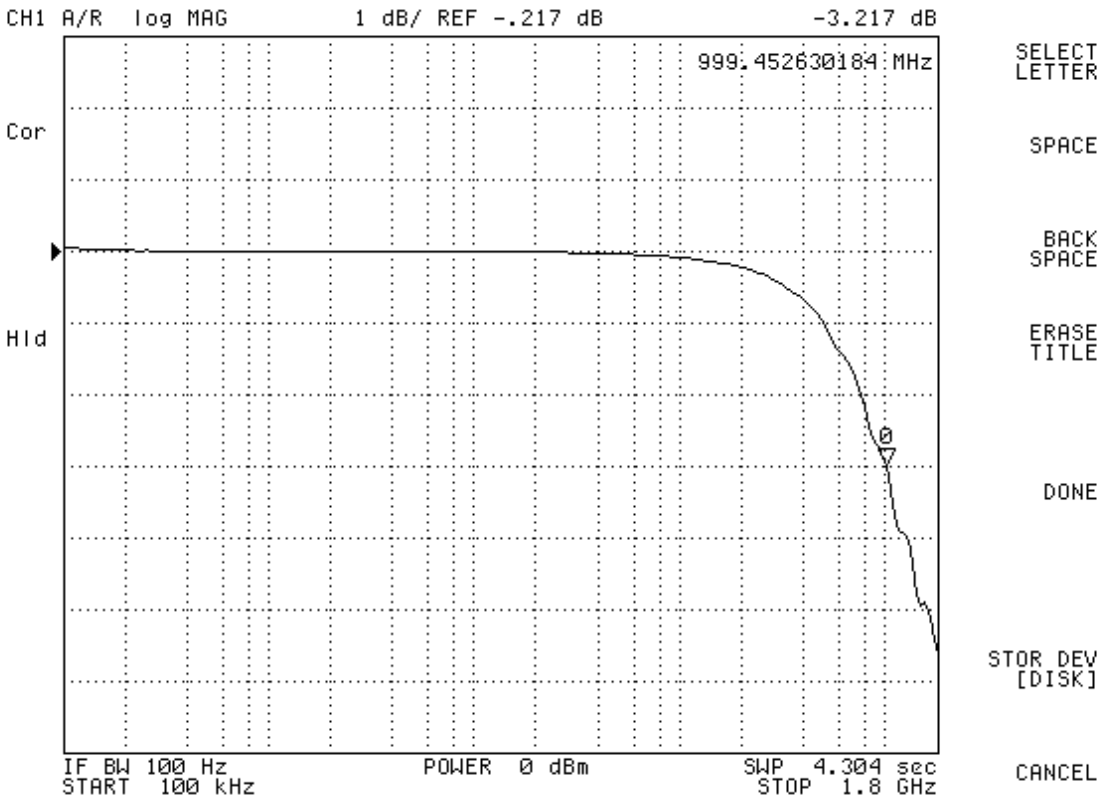

Figure 2, Insertion Loss of PI53V520, the –3.217db point is at 999.45Mhz

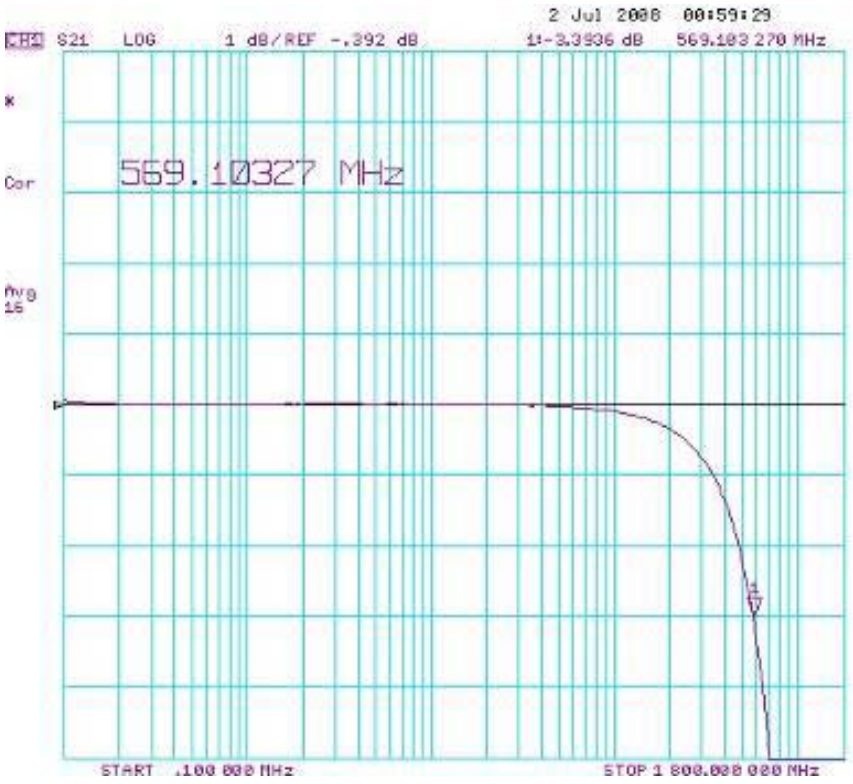

Figure 3, Insertion Loss of PI5V330S, the –3.39db point is at 569.1Mhz

Termination, AC coupling, DC isolation and offset

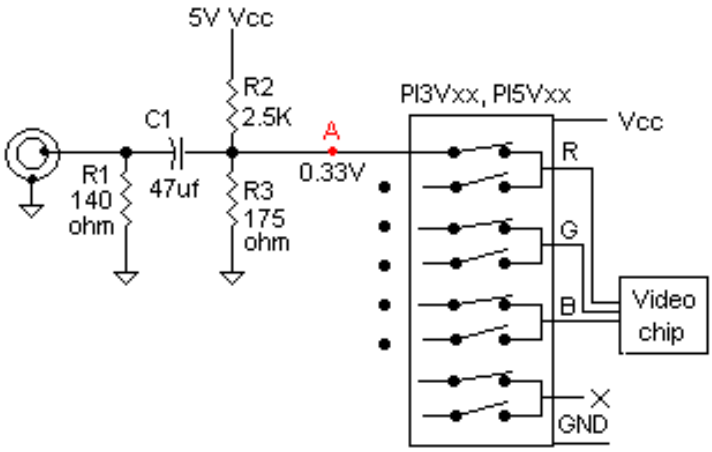

Figure 4, Video Input Circuit for DC Isolation, AC Coupling and Impedance Termination

For interface switches, the TV hot-swap condition is more critical than the industry system hot-swap.

When the video cable banana connector from a DVD is plugging into the RCA connectors on the TV, the signal pins of the DVD and TV may contact before the contact of the ground pins.

Thus, the ground voltage difference between the DVD and TV will release through the signal pins of the video switch.

This will cause an EOS (Electrical Over Stress) surge current, which often damage the video switch. As a comparison, in the industry system hot-swap applications, the ground pins will connect before the signal pins.
In order to protect the video switch from the EOS damage, the AC coupling capacitor C1 in figure 4 will stop the DC current caused by the ground voltage different between the DVD and TV, thereby will prevent the EOS DC current, which is the major EOS damage energy due to its longer time duration compared to the AC surge current.

C1 is also for DC offset. The video output circuit of some video source devices (DVD, STB, etc) may have series AC coupling capacitors, thereby the video signal will ride on the 0V DC common voltage from the termination resistors in the TV and may reach below –0.5V, when undershoot occurring, which will turn-on the off-channel in the video switch and will cause interference between the on-off channels.

Combined with R2 and R3 (figure 4), C1 will offset the DC common voltage to +0.33V at point A (figure 4). Thus, the video signal with 1V peak will ride on the +0.33V DC common voltage and will not go down below –0.5V.

In figure 4, R1 (140ohm), R2 (2.5K) and R3 (175ohm) will consist a 75ohm termination to terminate the video cable and the video driver both with 75ohm impedance.
2.5K(R2) // 175ohm (R3) = 163.55ohm
140ohm (R1) // 163.55ohm = 75.43ohm

The resistance ratio of R1, R2 and R3 shall be adjusted for the optimization of a particular application design.

The capacitance of C1 can vary in the range of 10uf to 100uf, depends on the requirement of application design.

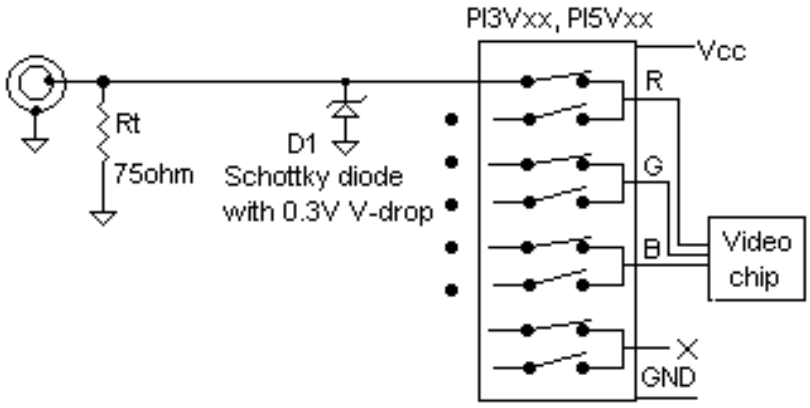

Figure 5, Video Switch Using Schottky Diode

The circuit in figure-5 uses Schottky diode D1 to clip the negative voltage below –0.3V, thereby will prevent the negative voltage turning-on the off-channels, thereby will prevent the interference between the on-off channels.

The circuit in figure 5 uses fewer components than the circuit in figure 4.

But the concern for the circuit in figure 5 is that if there was a AC coupling in the video source (DVD, STB, etc), the video signal will ride on the 0V DC offset from the termination and the Schottky diode may cancel useful content in the video signal at -0.3V.

The circuits provided in this application note are generic reference circuits only good for reference. When use these circuits for real application designs, adjustment and final validation are important to ensure the proper functions.

Conclusion

Pericom provides a full line of video switches with high performance, low crosstalk and fast switching time. The PI3Vxx and PI5Vxx video switch families are suitable for all types of analog video signal applications and providing an optimum cost-performance solution. These solutions make Pericom the leader in the video signal switch markets.

Datasheets, IBIS, Samples, Tech Support, Application Notes, and more can be found on the company website www.pericom.com/video.