LAN Switching Techniques Using The PI5L100 & PI5L200

by Mike Parsin November 11, 1996

Introduction

Generally, it is quite difficult to replace mechanical reed relays. This note, however, describes how the PI5L100/200 LanSwitch not only makes this replacement but does it easily. A brief description of how the switch operates, with its benefits, is followed by several applications including, 10BaseT, 100BaseVG-AnyLAN, and Fast Ethernet switching techniques. Other general purpose uses such as loopback, line terminations and line clamps are also described here.

Operation

The PI5L100/PI5L200 is configured as a quad 2:1 mux or demux. Bandwidths to 200Mbps make this switch ideal for various standards shown in Table 1.

Data signal levels from 0 - 4.5V (10Base-T) can be s witched with minimal distortion. The on-resistance of each channel (see Figure 1) changes by 10Ω (5L100) through the signal input range which translates to 10%. The 5L200 changes only 2%.

$$\text{Distortion (\%)} = \Delta Ron / R_L$$

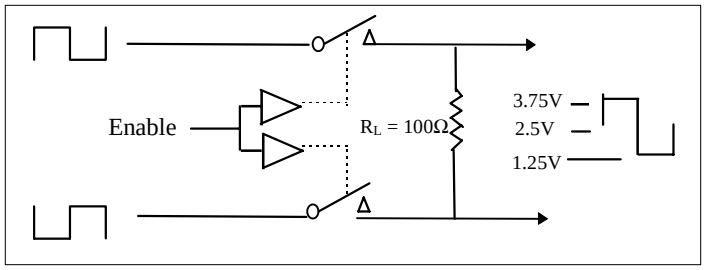

Figure 1. Differential Operation For 100VG

For example, in 100VG systems (See Figure 3), the LanSwitch should always be inserted between the PI2C5001 and the magnetics or logic side of the magnetics (**not on the connector or line side**).

100VG and Ethernet Operation

All major protocols differentially transmit and receive data. Therefore the LanSwitch must operate in pairs. Figure 1 shows this basic operation. It should be noted that most Unshielded Twisted Pair (UTP) systems are 100Ω impedance. The 100VG data is offset by 2.5V and swings 2.5Vp-p around the DC component. Ideally the VG signal swings from 1.25V to 3.75V (Figure 1). Figure 2 shows the complete design for switching from 10Base-T to 100VG-AnyLAN. Figure 4 shows a typical NIC card. The LanSwitch has no problem when directly connected to typical magnetics such as the VALOR SF6040. It should be noted here that Pericom does supply a reference board that exhibits a PCI 10Base-T and 100VG NIC adapter card.

Table 1. Recommended LAN Standards

LAN Standards	Maximum Bandwidth UTP Data Rate per twisted pair.
10Base-T	10 Mbps
100Base-T	100 Mbps
100VG-AnyLAN	30 Mbps (encoded data)
Token Ring	4 / 16 Mbps
155ATM	155 Mbps (5L100 only)
25ATM	25.6 Mbps

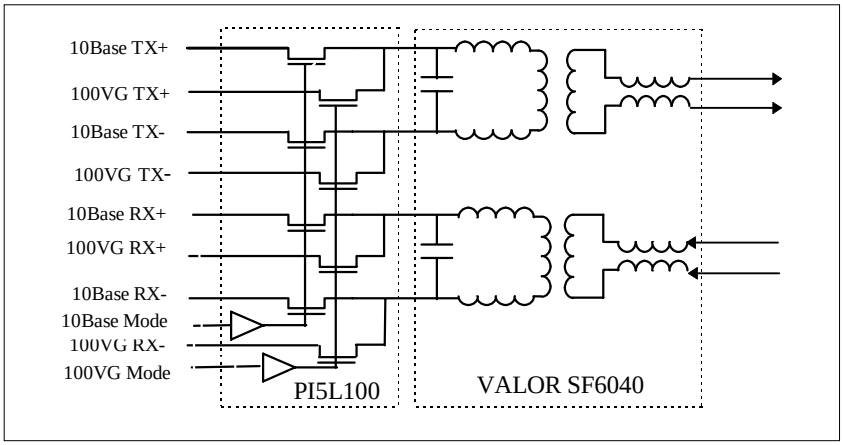

Figure 2. 10Base-T and 100VG-AnyLAN Switch

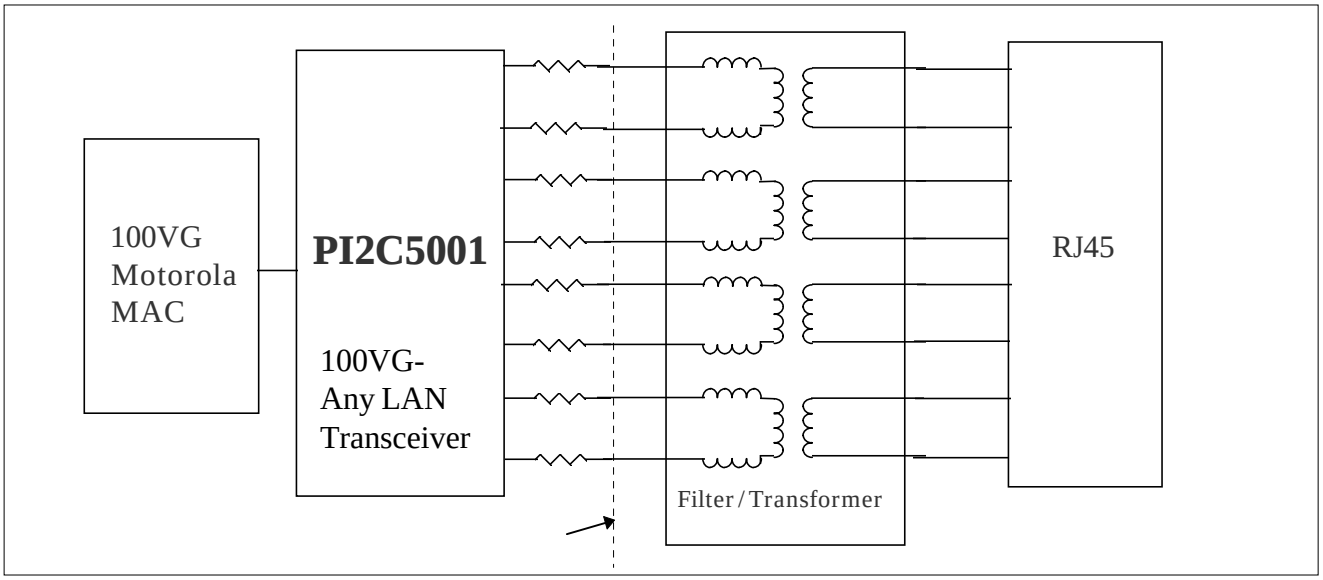

Figure 3. Proper Location of LanSwitch in 100VG System

Power Source Selection

The LanSwitch voltage source shown in Figure 4 is 6.2V (not needed for 5L200). This voltage was selected so as to keep the switch insertion loss or on-resistance to a minimum. It can be seen in figure 5 that this R_{ON} varies as the *data input signal* level increases. This means that R_{ON} is about 10Ω when the input level is 4.5V for the 5L100. R_{ON} is constant around 7Ω for 5L200.

Crosstalk...X_{TALK}

The LanSwitch was measured for non-adjacent X_{TALK} and showed a very respectable -28dB at 100 MHz as seen in Figure 6. Crosstalk is defined here as noise or unwanted signals coupled from one channel to another. For instance, data from a RECEIVE (RX) channel coupled into a TRANSMIT (TX) channel in a full duplex transmission will result in error at the receive end. Sometimes X_{TALK} happens in the magnetics. In (full duplex) Ethernet the RX 100Base-T and RX 10Base-T transformers may couple data. The 5L100/200 can be inserted in the 10Base-T path to isolate data when fast ethernet is receiving data. Pericom uses a HP4195A Network Analyzer to measure X_{TALK} (see Figure 7). By looking at the channel which is selected as the TX and injecting a signal into the RX channel.The actual X_{TALK} is measured in dB as the signal sweeps from 1MHz to 300MHz.

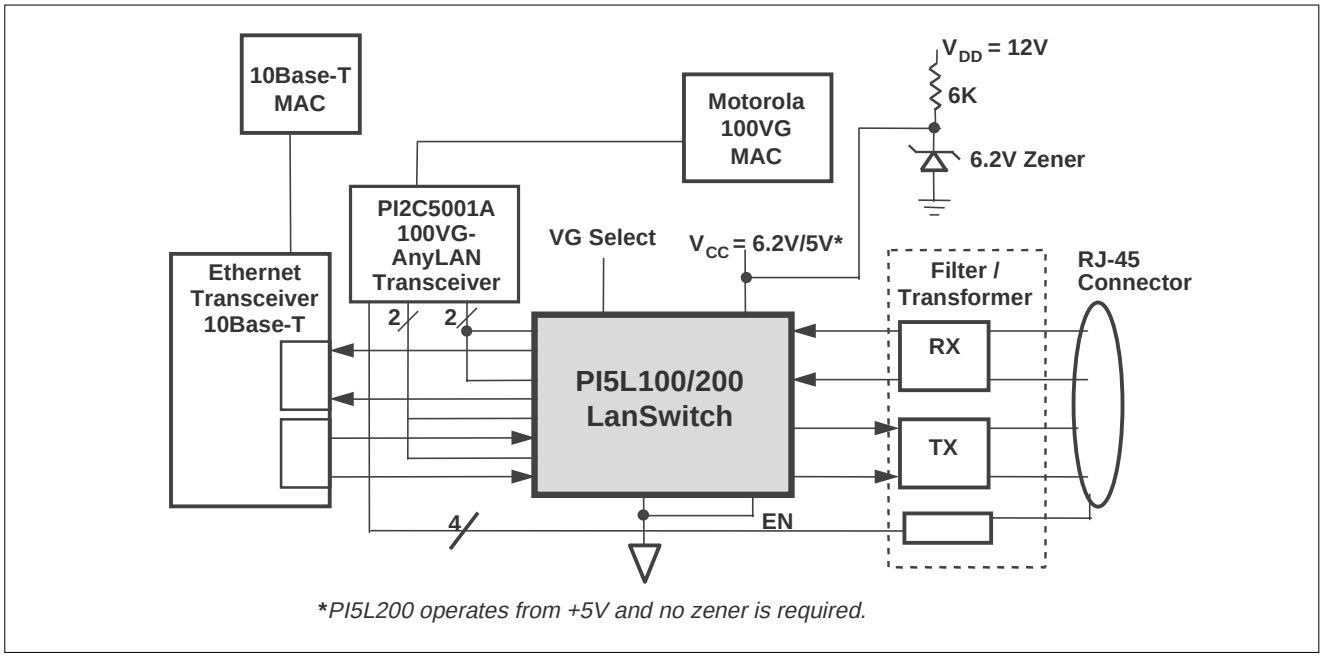

Figure 4. Complete 10Base-T / 100VG-AnyLAN System

Other Applications

A loopback circuit is shown in Figure 8a for checking tranceiver operation. When line terminations (or clamps) need to be inserted in the line, the circuits in Figure 8b and 8c give an idea on how to use the LanSwitch.

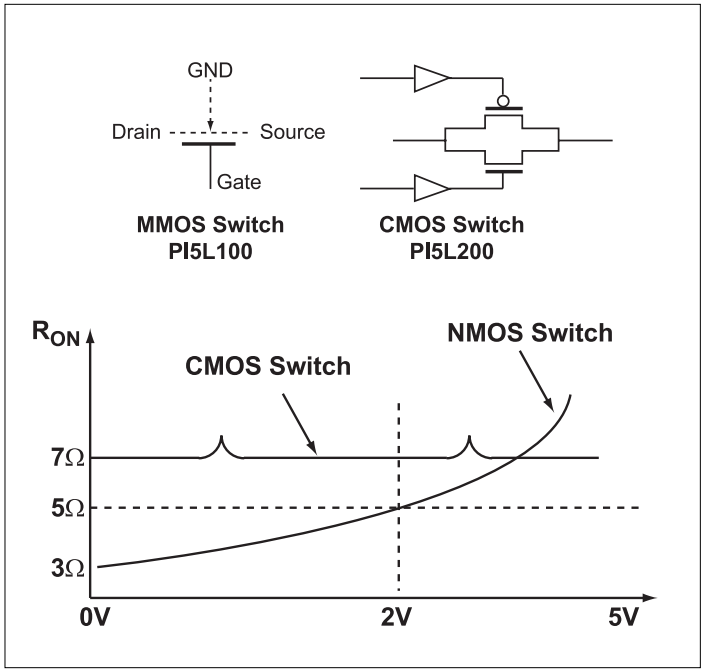

Figure 5. Basic PI5L100 / 200 Switch

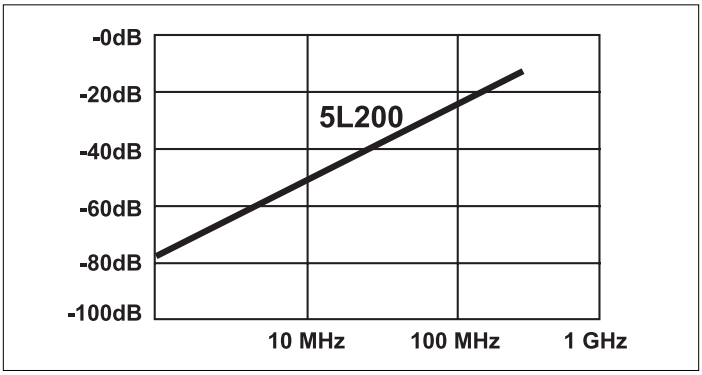

Figure 6. X_{TALK} vs. Frequency

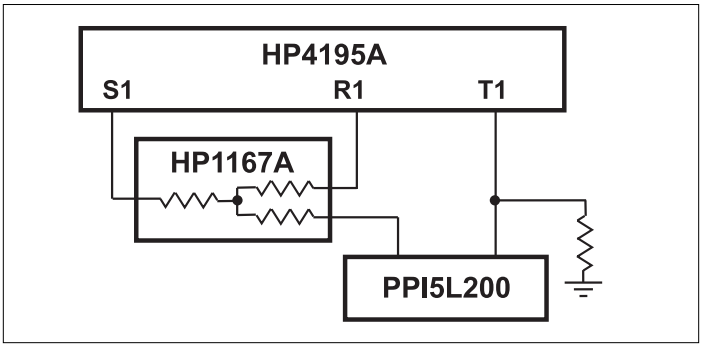

Figure 7. X_{TALK} Test Setup

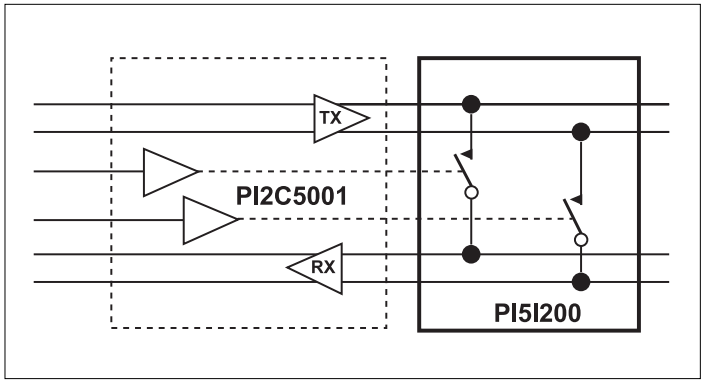

Figure 8a. Loopback

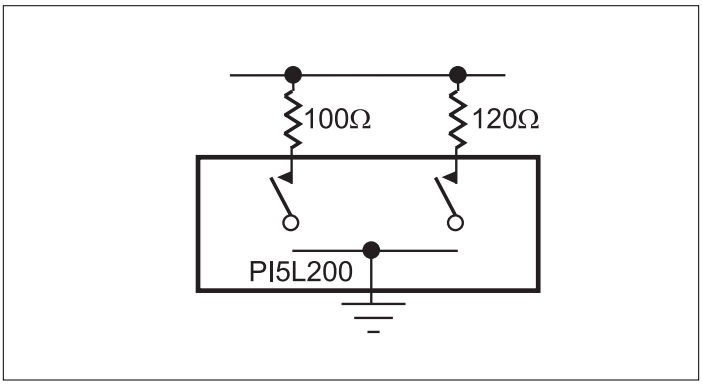

Figure 8b. Line Terminations

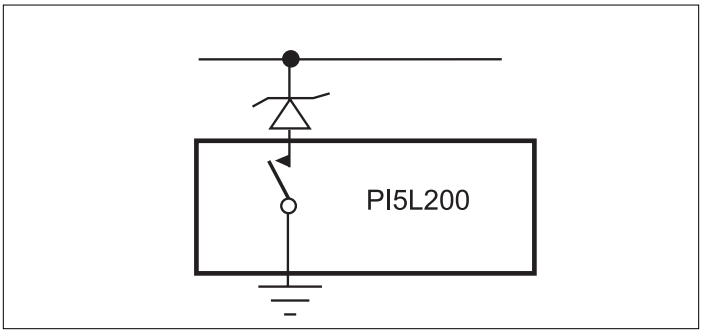

Figure 8c. Line Clamp