

LanSwitch™ in Ethernet Applications

by Mike Parsin 8/19/96

Introduction

This brief will describe the PI5L100/200 LanSwitch in Ethernet applications. Included are some typical switching techniques for 100Base-TX, 100Base-T2, 100Base-T4 and 10Base-T protocols. The PI5L100/200 is configured as a quad 2:1 multiplexer and is ideal for replacing mechanical reed relays for data switching.

Crosstalk Problems

When 10Base-T, and 100Base-TX or T2 (all use 2 pairs for full duplex transmission) data goes through a mutual component, such as the magnetics, crosstalk (Xtalk) can occur. For instance it is common for unwanted data to be coupled from a high frequency source like 100Mbps 100Base-TX into the 10Base-T transformer because both are in the same package and are physically close, which can cause the mutual capacitance (see Figure 1) to be an issue.

$$\text{Xtalk (Adjacent Pin) \%} = C_m R_{\text{parallel}} Z / t_r$$

Actually it is possible to crosscouple the incoming receive data packet of 100Base-TX into 10Base-T when both are in the receive mode. This will only occur when the 10Base-T transceiver does not have wave shaping or a lockout feature. As the data rate increases the chance for excessive Xtalk will increase (see Pericom Application Brief 5). Actually the edge rate plays a significant role in determining Xtalk.

For instance, if the edge rate is 2ns, the effective input frequency is equal to $0.3/t_r$ or 150MHz. The solution is to insert the 5L100/200 in the 10Base-T circuit. This isolates unwanted Xtalk coupled into

the 10base-T lines when 100Base-TX is active. The line is then terminated with two 50Ω resistors to ground to match the 100Ω line. Ethernet signals at the logic side of the magnetics swing from 0V to 4.5V. This means the 5L100/200 must pass these levels with minimal insertion loss or distortion. It should be noted that with $V_{CC} = 6.2V$ the output distortion is about 5% to 10% into a 100Ω load.

Ethernet Data Rates

Basically 100TX can push data up to 100Mbps in full duplex mode over 2 unshielded twisted pair cables (UTP). If the data rate is twice the bandwidth frequency, then the actual -3dB analog bandwidth of the switch is 1/2 the data rate.(see Figure 2). This means that the LanSwitch™ (5L100 only) can operate in not only Fast Ethernet circuits but also extended 155ATM applications that run at 155Mbps in CAT5 cable applications.. It should be noted that TX uses CAT5 data grade and T2 can operate on CAT3 voice grade cable.

100Base-TX Inter Repeater Link Crossover

When connecting one repeater to another repeater, crossover wiring is required. The best way to accomplish this is to do the crossover wiring within the repeater hub. The transmit and receive lines should be reversed as they enter the RJ45 8-pin connector (see Figure 3). A single 5L100/200 switch should be inserted between the transceiver and magnetics.

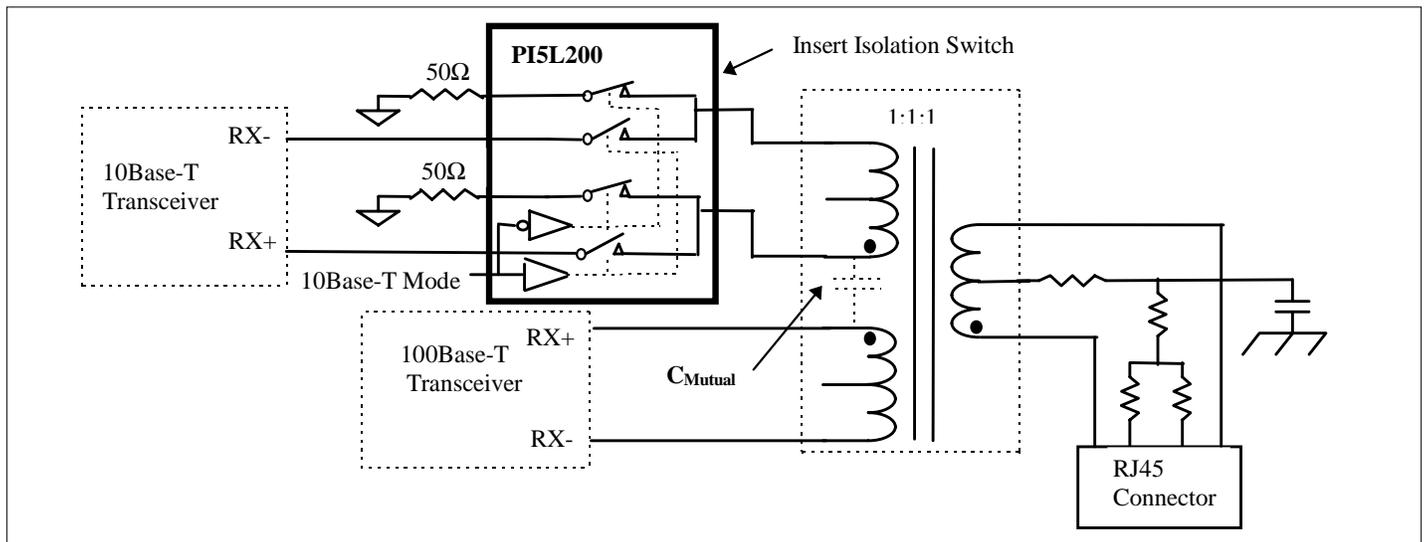


Figure 1. Ethernet Signal Levels

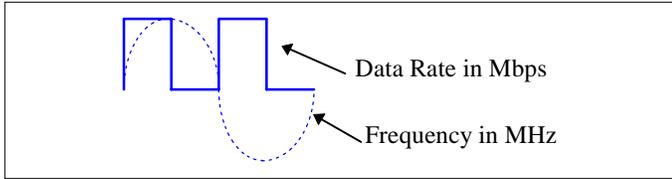


Figure 2. Data Rate vs. Frequency

Figure 4 shows a method for doing a Inter Repeater Link (IRL). Generally the the 5L100/200 would be set to the normal mode. The solution is to insert three 5L100/200 devices. The repeater hub incorporates the crossover function and that port should be designated with an "X". All 4 pairs of UTP cable are use in 100T4. Actually CAT3 cable allows transmission over 150 meters which makes up for its limitations since its only half duplex. The 100Mbps transfer rate is spread over 4 twisted pairs, so each pair transmits only 25% of the full bandwidth which reduces crosstalk and extends the transmission cable length.

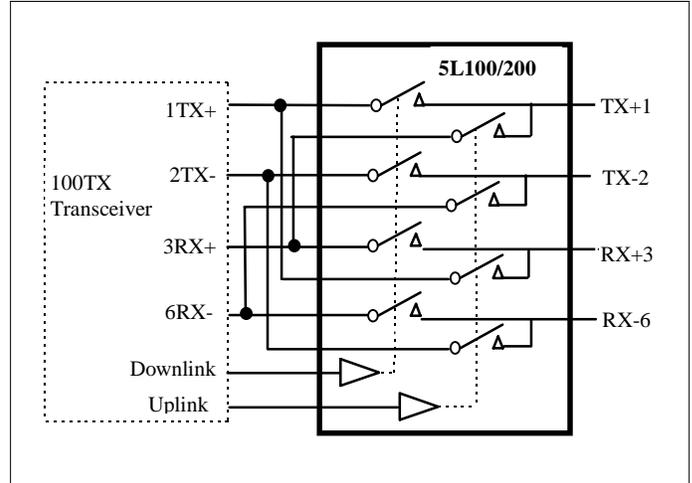


Figure 3. 100Base-TX IRL Crossover

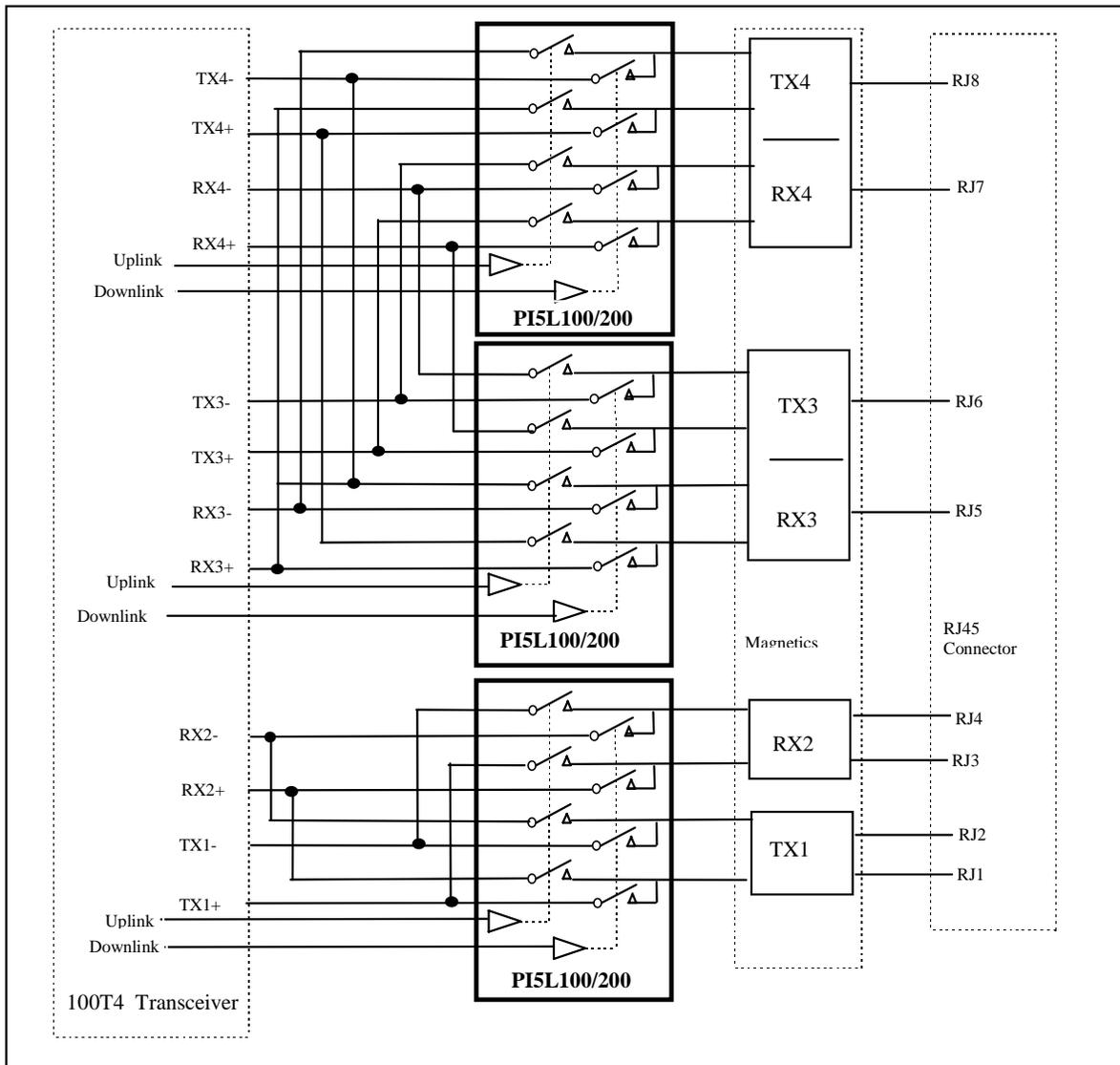


Figure 4. 100Base-T4 IRL Crossover

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