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To: Members of X3T10

Subject: Presentation of crosstalk experiments relating to single ended and LVDS drivers.

Physical Setup

The GND/+REQ and the -REQ signals are disconnected at the connector on the host adapter board at each end of the cable. These lines are then tied to the resister network as shown to simulate the termination of a low voltage differential line. The rest of the bus is left connected to the SCSI protocol chip and the single ended terminator at each end. The -C/D line is then asserted for a length of time and then released. A scope connected to the -C/D line as well as the two differential lines at the near (asserting) end records the transitions in order to show the cross talk affect on the cable. There are no other loads on the cable. Three cables are tested: a 'standard' 50 pin flat ribbon cable, a 50 pin bundled twisted pair cable and a 50 pin flat twisted pair cable. The flat ribbon cable is tested for two lengths of cable, 1 meter and 4 meters. For comparison, an LVDS driver is attached to the flat ribbon cable with the termination as shown on the disconnected cable below. The adjancent lines are also terminated for LVDS as shown below. Scope traces from all cases are pictured on the following pages.

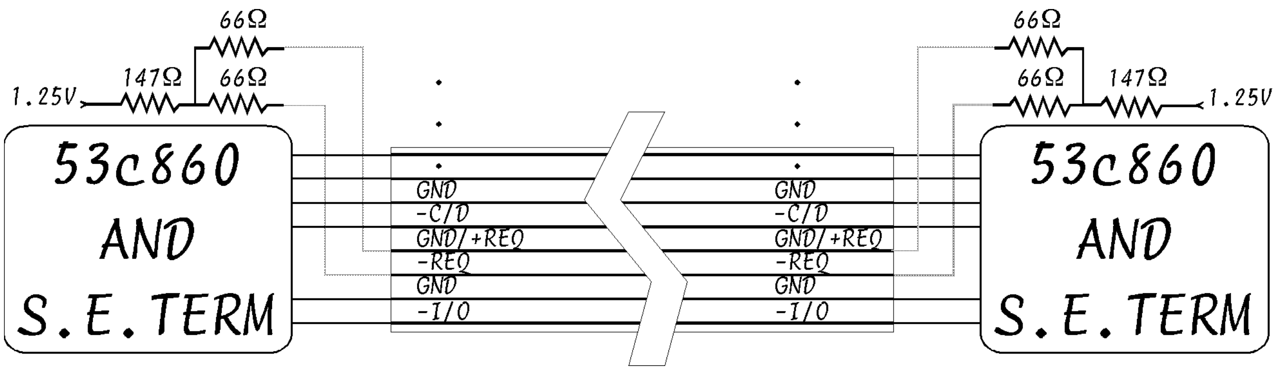


Figure 1: Schematic of cable and board assembly

Analysis

As expected the worst case for cross talk on the cable is with a flat cable when the -C/D line is deasserting. Here, the +REQ line reaches about 1.75 V and the -REQ line reaches about 2.15 V for a period of 30 ns. This gives a differential signal of 300 mV corresponding to an asserted REQ. The common mode voltage shift in this situation is about 700 mV. This differential voltage is well beyond the proposed terminator offset as well as the minimum detection threshold for a valid REQ pulse.

The bundled twisted pair cable improves the situation considerably, however there is still a significant period of time with a differential voltage of 50 mV. The common mode voltage is shifted in this case by about 200 mV.

The flat twisted pair cable produces the best cross talk immunity with essentially no near end differential voltage. The common mode voltage is shifted by slightly more than 300 mV. The reason for less differential voltage than the bundled cable may be attributed to the tightly twisting of the connectors in the flat cable. In the bundled cable, the connectors are very loosely twisted. The lower common mode shift in the bundled cable is due to the twisting between the pairs within the bundle.

The LVDS driver produces a differential crosstalk voltage of below 50 mV which is well below the threshold limit of the proposed terminator biasing point.

The first cable tested is approximately four meters long and has the following characteristics: Flat ribbon with 1.27 mm conductor spacing, Characteristic impedance = 100 ohms, Capacitance (pF) per meter = 41.3, Insulation material = PVC, Propagation Delay (ns/m) = 4.59.

GND/+REQ and -REQ at near end (400 mV/div)

-C/D (2 V/div)

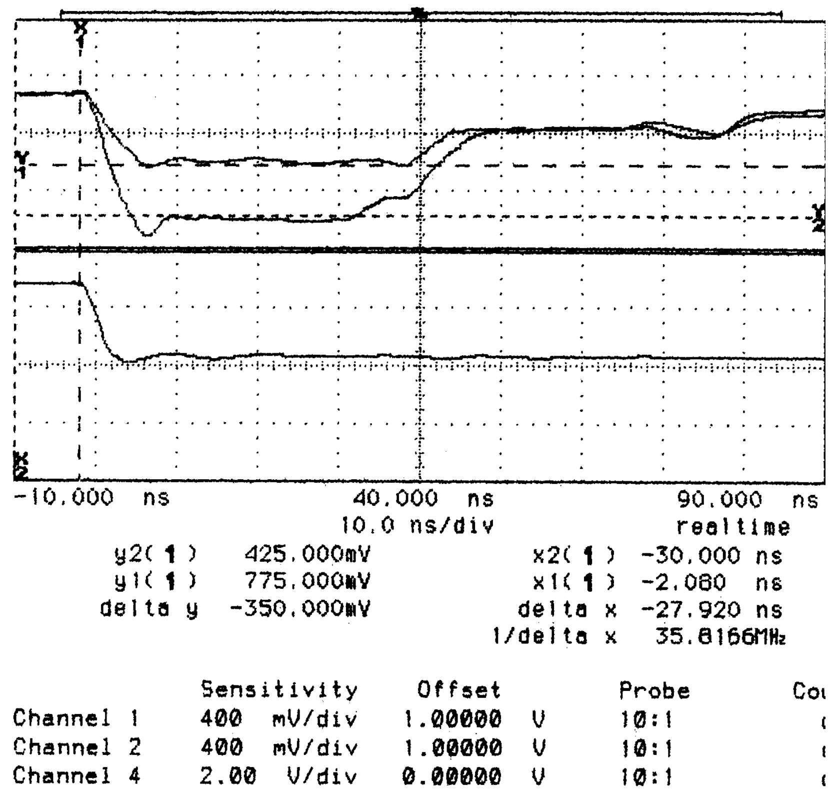


Figure 2: Assertion edge of -C/D using 4 meters of flat ribbon cable

GND/+REQ and -REQ at near end (400 mV/div)

-C/D (2 V/div)

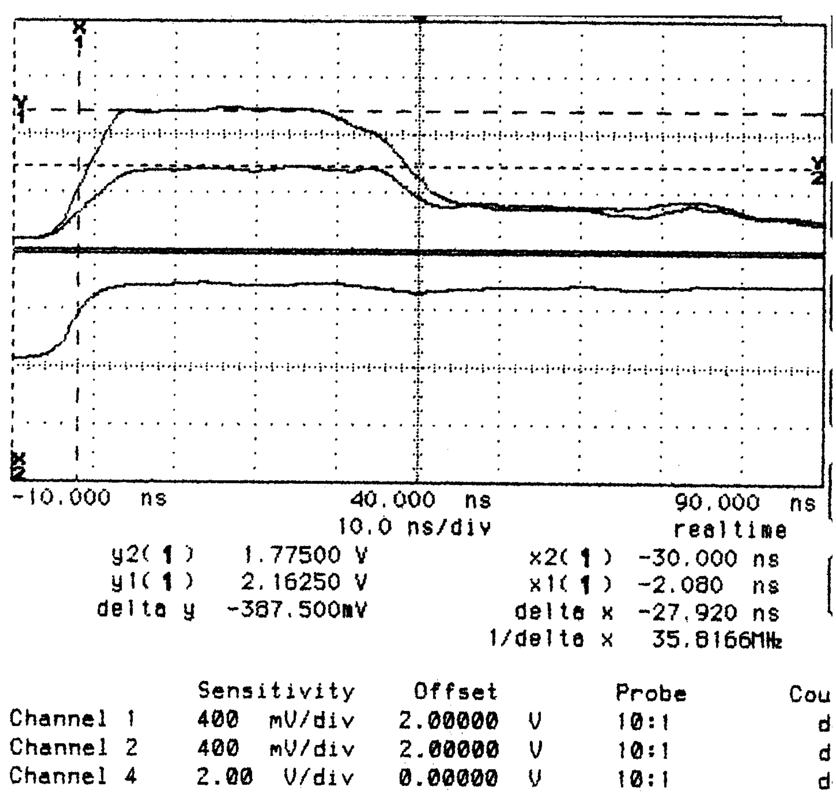


Figure 3: Deassertion edge of -C/D using 4 meters of flat ribbon cable

A 1 m. cable with the same electrical characteristics as in the first test is implemented.

GND/+REQ and -REQ at near end (400 mV/div)

-C/D (2 V/div)

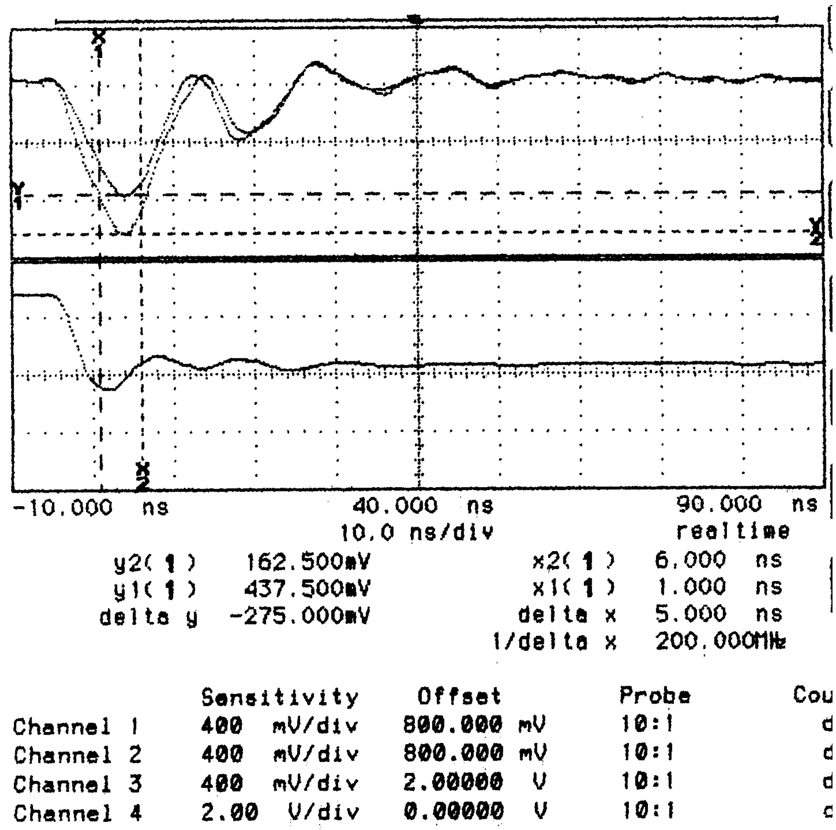


Figure 4: Assertion edge of -C/D using 1 meter of flat ribbon cable

GND/+REQ and -REQ at near end (400 mV/div)

-C/D (2 V/div)

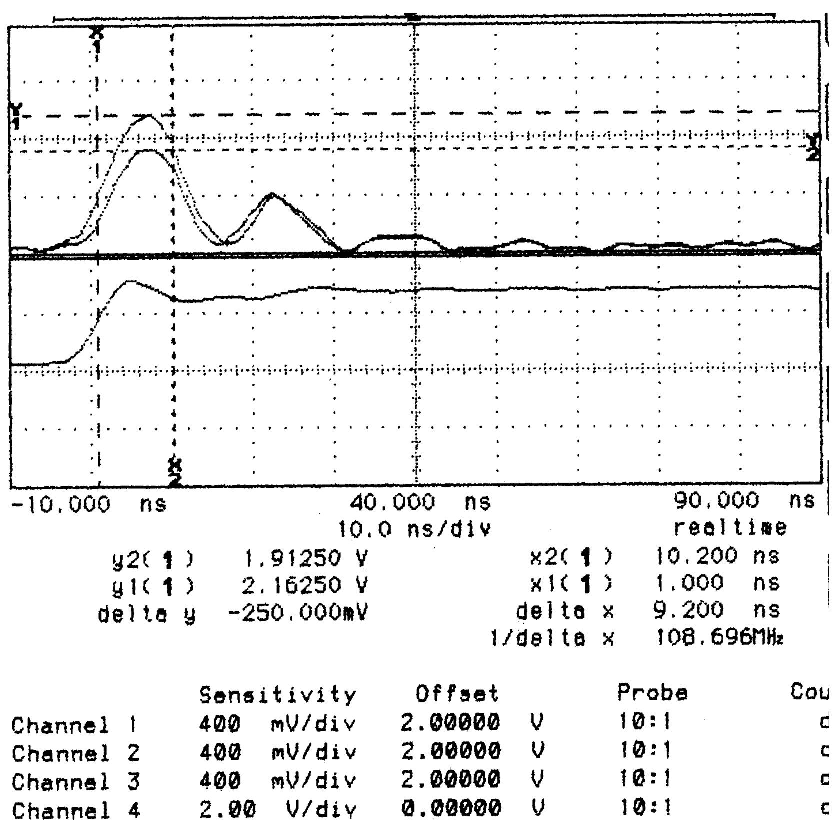


Figure 5: Deassertion edge of -C/D using 1 meter of flat ribbon cable

The second cable tested is a bundled twisted pair cable with an ungrounded shield. The cable is approximately 6 meters long and the exact electrical characteristics are unknown.

GND/+REQ and -REQ at near end (100 mV/div)

-C/D (2 V/div)

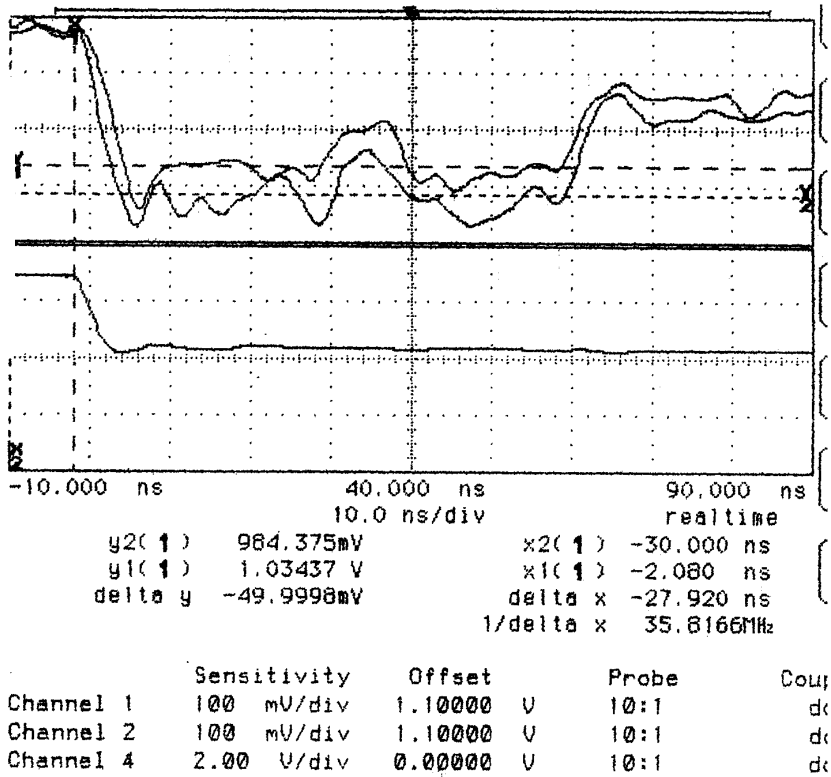


Figure 6: Assertion edge of -C/D with bundled twisted pair cable

GND/+REQ and -REQ at near end (100 mV/div)

-C/D (2 V/div)

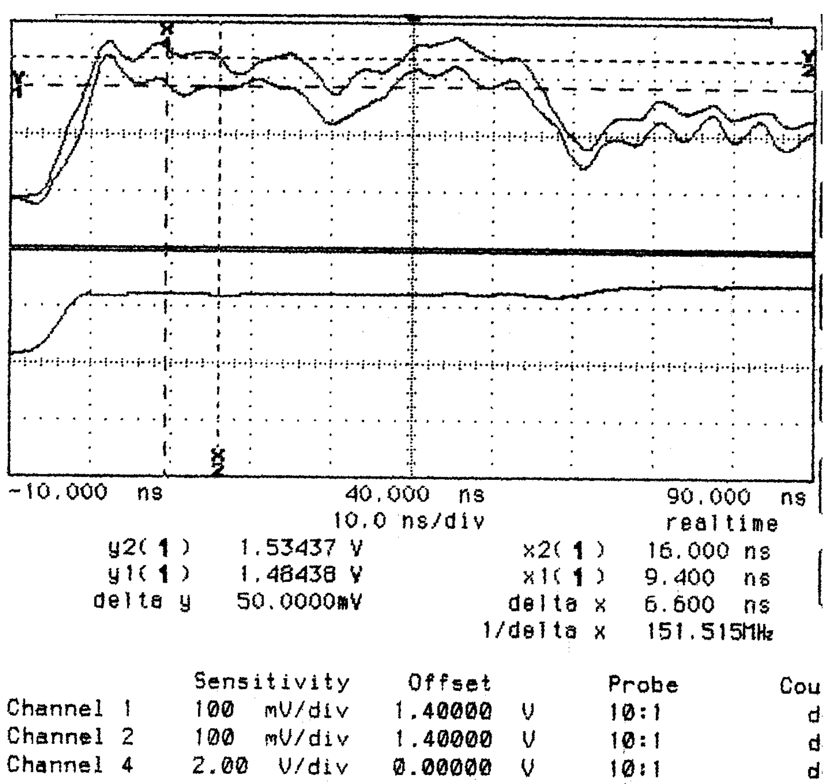


Figure 7: Deassertion edge of -C/D with bundled twisted pair cable

The third cable tested is a flat twisted pair cable. The cable is approximately 15 meters long and the exact electrical characteristics are unknown.

GND/+REQ and -REQ at near end (200 mV/div)

-C/D (2 V/div)

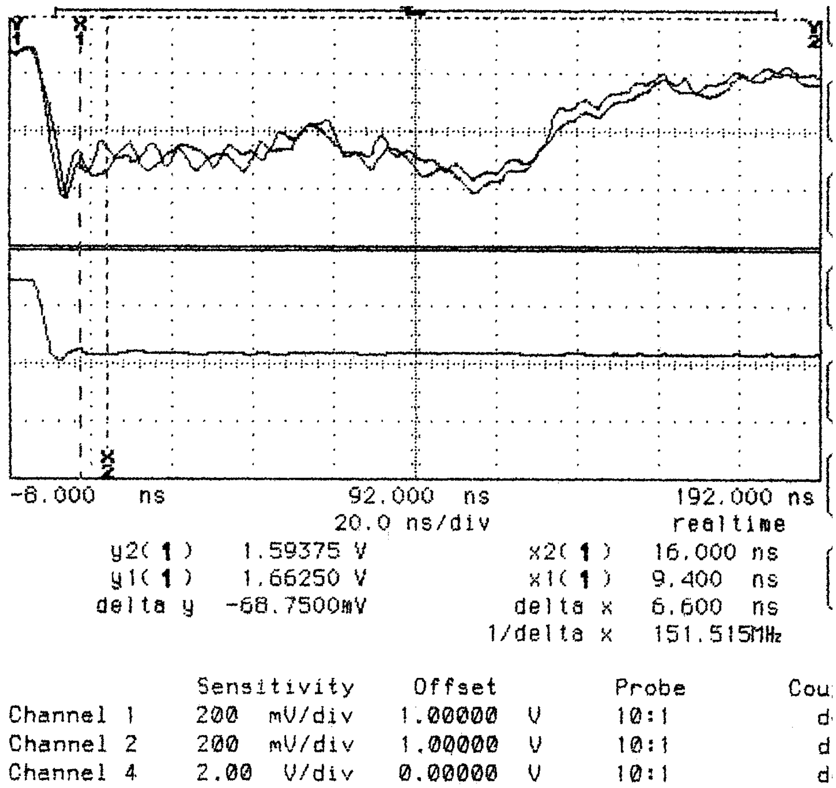


Figure 8: Assertion edge of -C/D with flat twisted pair cable

GND/+REQ and -REQ at near end (400 mV/div)

-C/D (2 V/div)

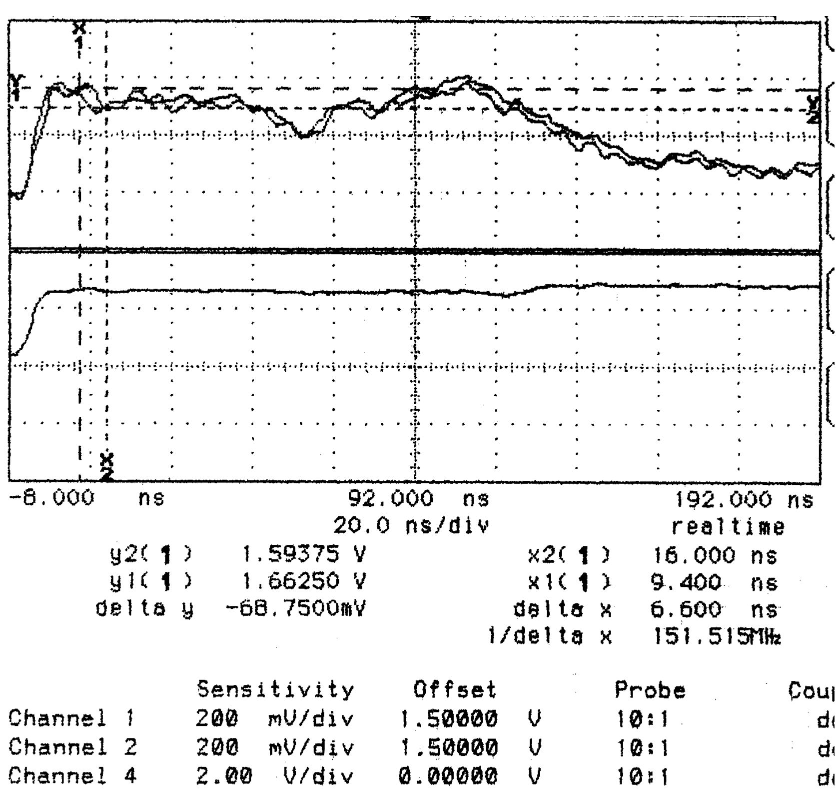
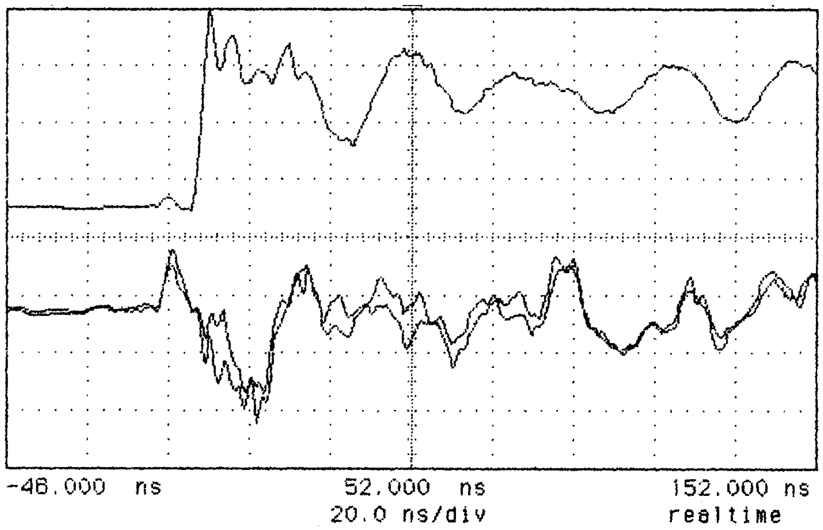


Figure 9: Deassertion edge of -C/D with flat twisted pair cable

An LVDS driver is attached to the flat cable at lengths of 1 and 4 meters; the same cable discussed earlier. The LVDS driven signal and an adjancent pair of signals are displayed.

LVDS driven signal
(100 mV/div)

Adjancent differential
pair (50 mV/div)

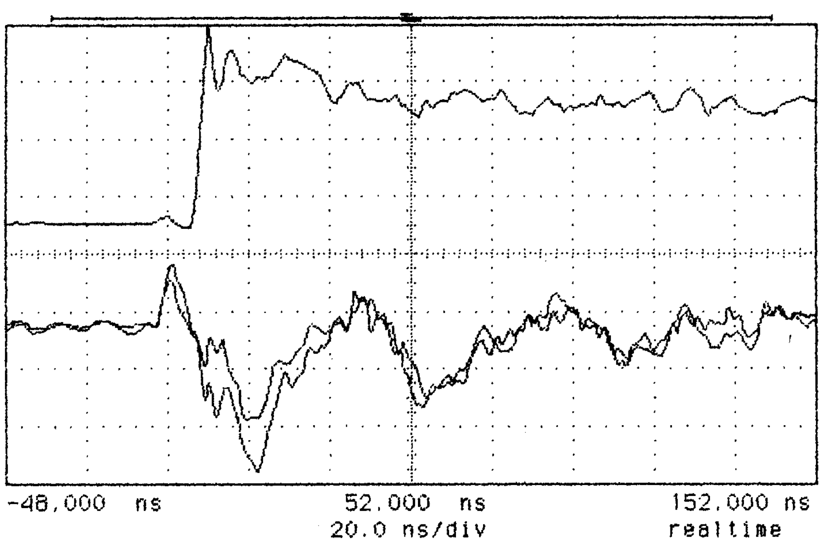


	Sensitivity	Offset		Probe	Cou
Channel 1	50.0 mV/div	1.30000	V	10:1	c
Channel 2	100 mV/div	1.05000	V	10:1	c
Channel 4	50.0 mV/div	1.30000	V	10:1	c

Figure 10: Transition edge of LVDS driver using 1 meter of flat cable

LVDS driven signal
(100 mV/div)

Adjancent differential
pair (50 mV/div)



	Sensitivity	Offset		Probe	Cou
Channel 1	50.0 mV/div	1.30000	V	10:1	c
Channel 2	100 mV/div	1.05000	V	10:1	c
Channel 4	50.0 mV/div	1.30000	V	10:1	c

Figure 11: Transition edge of LVDS driver using 4 meters of flat cable