Leading Pulse Tests
Using Ultra2 REQ Signal

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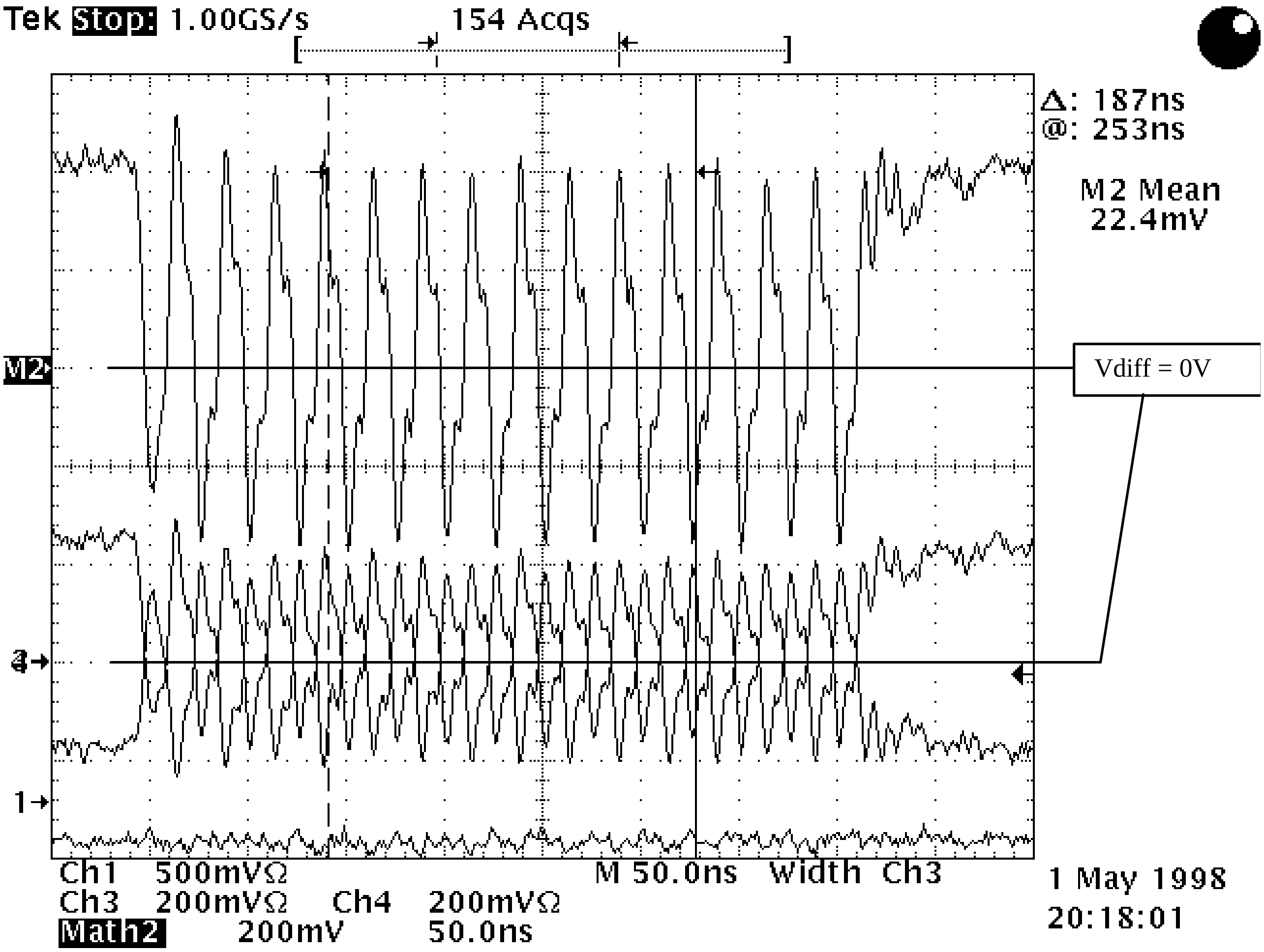
Premise:

Ultra3/Fast80 is assumed to use a dual-edge clocking scheme to double the transfer rate of the data. Because Ultra3/Fast80 would have the data switching at the same rate as the existing Ultra2/Fast40 REQ or ACK pulses, observation of the leading edge pulse gives us information to help analyze future requirements. Because the leading pulse, in a series of pulses, must initially "charge" the bus from a static value, the leading pulse will have a different pulse width, causing variation in the setup and hold time of the data. The data below is a measurement of this width difference in the leading pulse.

Setup:

- LVD, Fast40 Data Transfers
- 12 meter cable; active termination at both ends of the bus.
- 16 total devices on the cable: host at one end, 15 devices at the other end in a cluster with a spacing of 0.3 meters apart (cable capacitance: 45 pF/m).
- 14 devices in the cluster were dummy loads having the maximum LVD capacitance specified in SPI-2.
- The driving device was placed at the worst-case position for waveform distortion and attenuation as seen at the receiving end of the cable. This position was the mid-point of the cluster with 7 dummy loads on either side of the driver.
- Measurements were made with a Tektronix TDS684B scope using FET probes with < 2pF of capacitance. The probes were summed using the math function of the scope. (Differential probes were unavailable at the time of this test.) Whenever possible, single-ended and differential traces are shown simultaneously.
- All waveforms were recorded with the scope probes attached to +REQ and –REQ at the receiving end of the cable.

1. Overall Waveform – Envelope Mean Measurement

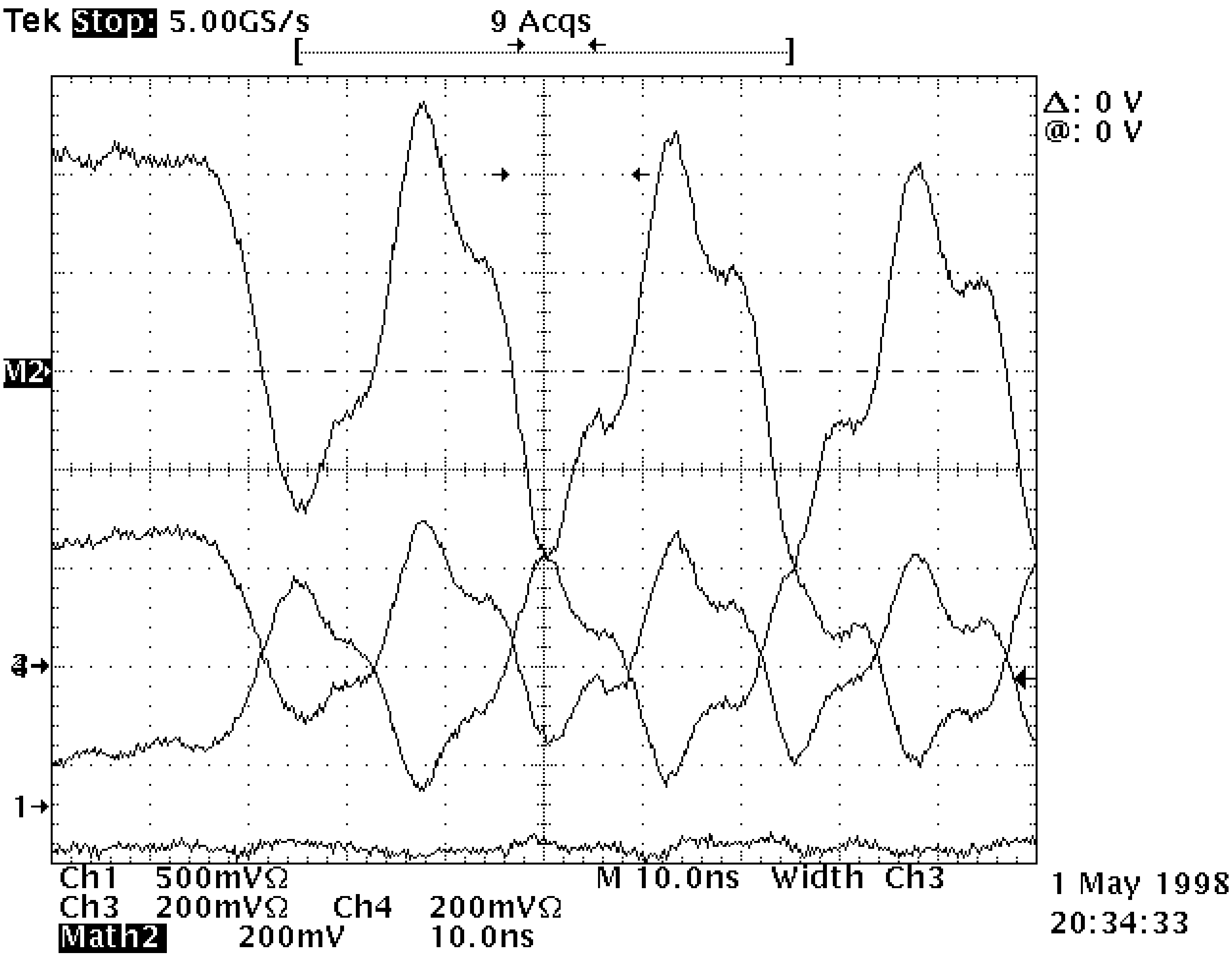


top trace: differential view of REQ (using scope math function)
mid traces: overlapped, single-ended traces of +REQ and –REQ
bottom trace: -I/O line, single-ended (low = target driving the bus)

REQ rate: 40MHz
Data offset: 15

Top trace mean voltage level: 22.4 mV (as measured by the scope math)

2. Expanded View of Leading Pulse – Vdiff = 0V

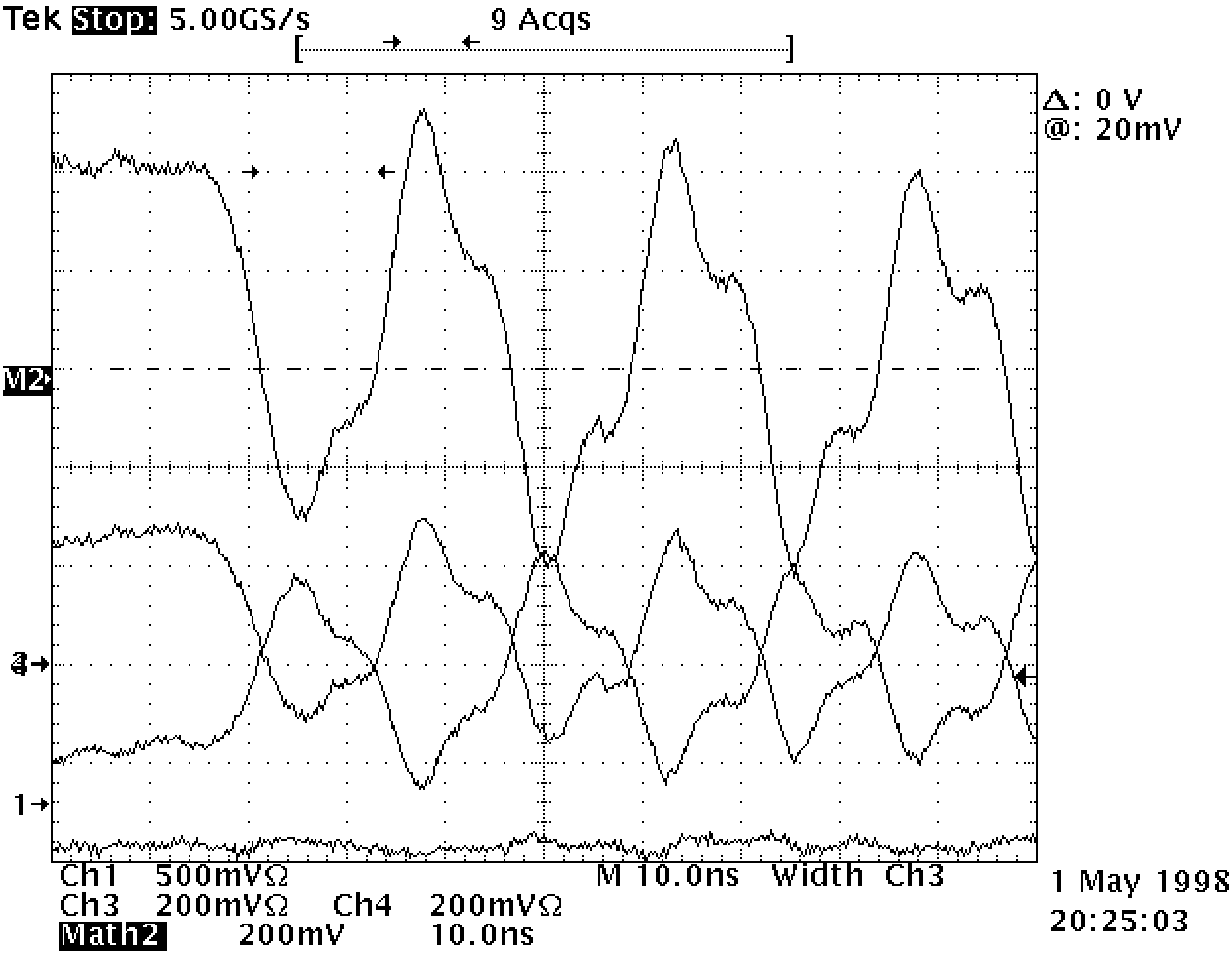


top trace: differential view of REQ (using scope math function)
mid traces: overlapped, single-ended traces of +REQ and –REQ
bottom trace: -I/O line, single-ended (low = target driving the bus)

REQ rate: 40MHz
Data offset: 15

Cursor shows Vdiff zero point of waveform for reference.

3. Expanded View of Leading Pulse – Vdiff Shifted down by Mean value

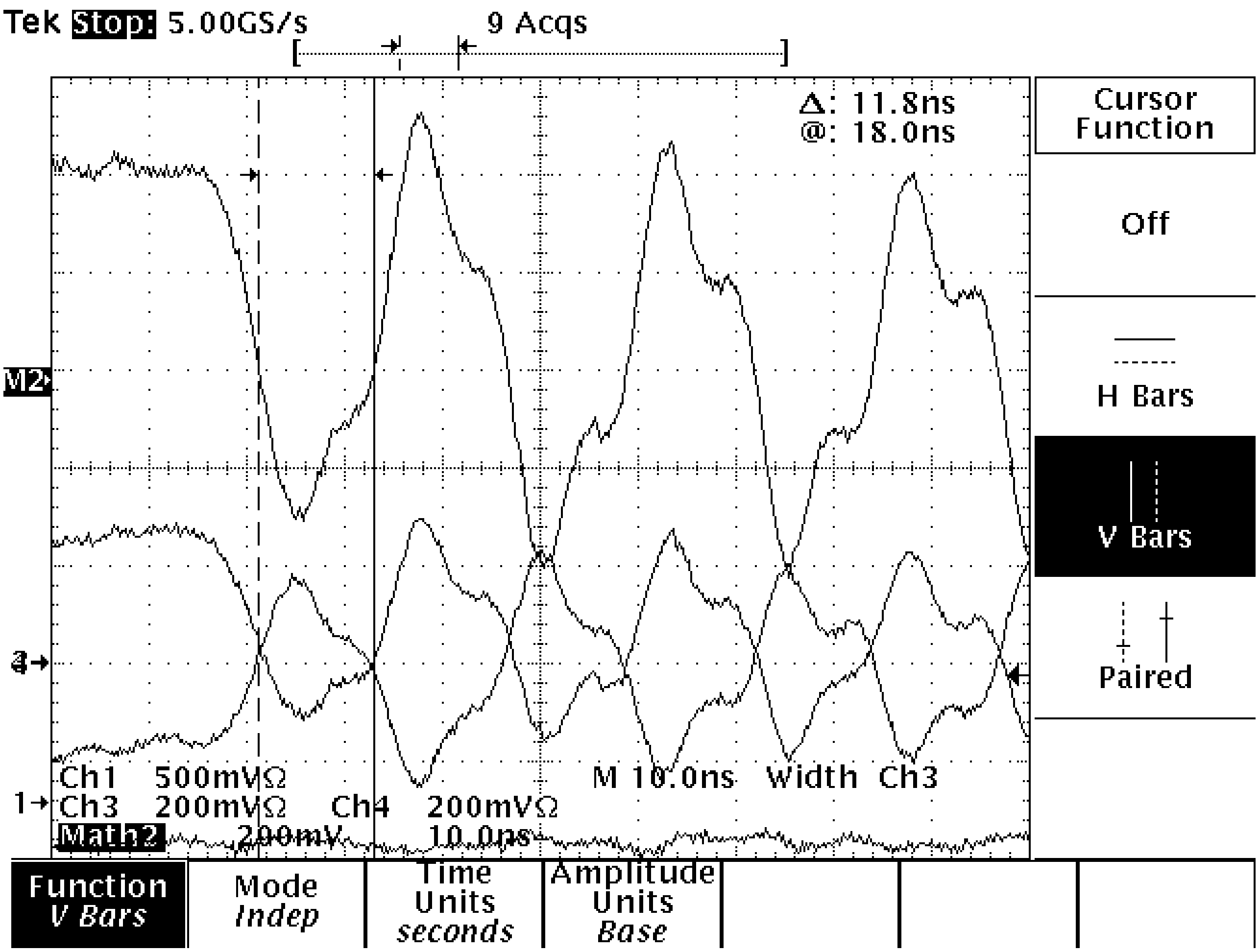


top trace: differential view of REQ (using scope math function)
mid traces: overlapped, single-ended traces of +REQ and –REQ
bottom trace: -I/O line, single-ended (low = target driving the bus)

REQ rate: 40MHz
Data offset: 15

Cursor shows Vdiff shifted down by the value of the mean (approx.) in order to use the graticule line to measure the waveform crossings in the next trace.

4. Expanded View of Leading Pulse – First pulse's width at graticule crossing

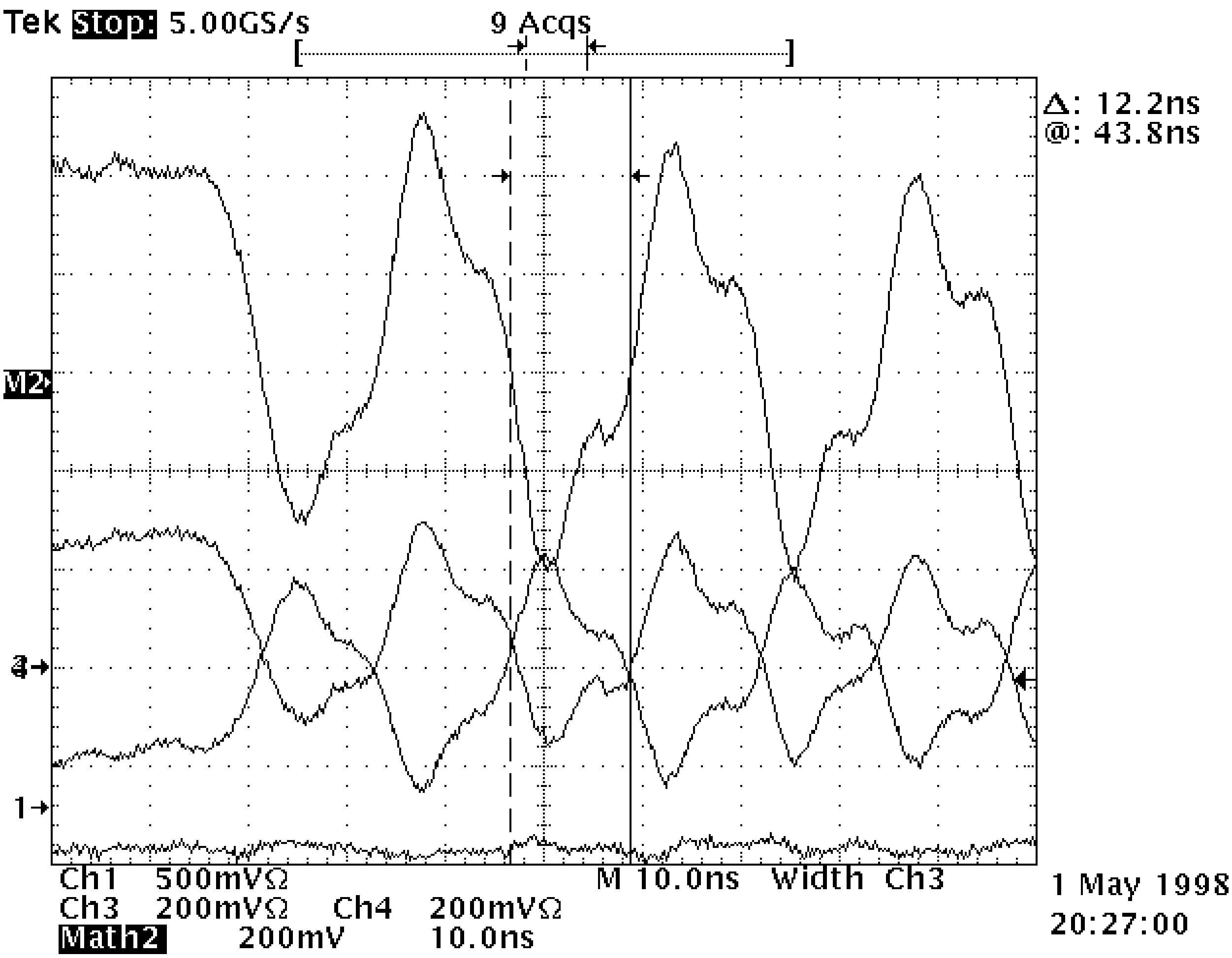


top trace: differential view of REQ (using scope math function)
mid traces: overlapped, single-ended traces of +REQ and –REQ
bottom trace: -I/O line, single-ended (low = target driving the bus)

REQ rate: 40MHz
Data offset: 15

Pulse width measured at graticule represents width at waveform's mean value. Mean value was chosen as a type of "zero crossing" reference point for making pulse width measurement comparisons. (See next trace.)

5. **Expanded View of Leading Pulse – Second pulse's width at graticule crossing**



top trace: differential view of REQ (using scope math function)
mid traces: overlapped, single-ended traces of +REQ and –REQ
bottom trace: -I/O line, single-ended (low = target driving the bus)

REQ rate: 40MHz
Data offset: 15

Pulse width measured at graticule represents width at waveform's mean value. Mean value was chosen as a type of "zero crossing" reference point for making pulse width measurement comparisons. (See last trace.)

Conclusions:

Leading Pulse = 11.8nsec
Second Pulse = 12.2 nsec

Difference in pulse width = 0.4nsec

This reduces the hold time from the data to the leading REQ/ACK edge of a series. This also reduces the setup time between the data and the second REQ/ACK of this series.