Proposed Draft

Serial ATA International Organization

Version 1
26 August 2008

Serial ATA Revision 2.6 ECN # 025
Title : Rise Time Measurements

Author Information

Author Name	Company	Email address
John Hill	STMicroelectronics, Inc	John.hill@st.com

Workgroup Chair Information

Workgroup (Phy, Digital, etc…)	Chairperson Name	Email address
PHY Working Group	Chuck Hill	cphill@altaeng.com

Document History

Version	Date	Comments
0	26 August 2008	Initial Draft.
1	27 August 2008	Corrected typo in section 1.3

1 Introduction

1.1 Problem Statement

The present rise and fall time measurements are to be measured using multiple test patterns that include the LBP. No time span of the analysis zone is specified. The combination of these conditions leads to inconsistent results depending on how the actual measurement is performed.

More detail is provided in the paragraphs that follow:

The present test patterns for the measurement of rise and fall time are the HFTP, LFTP and LBP. The 20% to 80% amplitude levels are specified as the time measurement points, and the 0% and 100% reference levels are specified to be measured with the “mode” measurement method.

In the case of the LBP, the choice of the time span and location within the pattern where the mode measurement is made, determines various results of the 0% and 100% reference levels. This produces multiple reported rise and fall time levels depending on where in the pattern and how long the time span is for the mode amplitude measurement. The method of dealing with the multiple reported values is not specified. (average, min-max)

For the HFTP, the mode amplitude could be different from the mode amplitude of the LFTP depending on emphasis levels and BW. Even though the actual time rate of change of voltage on the transition may be identical in the patterns, the reported rise and fall times may be different. This causes a lack of correlation of measurements between sites.

1.2 Solution

Specify that the rise and fall time measurements are to be performed using only the LFTP.

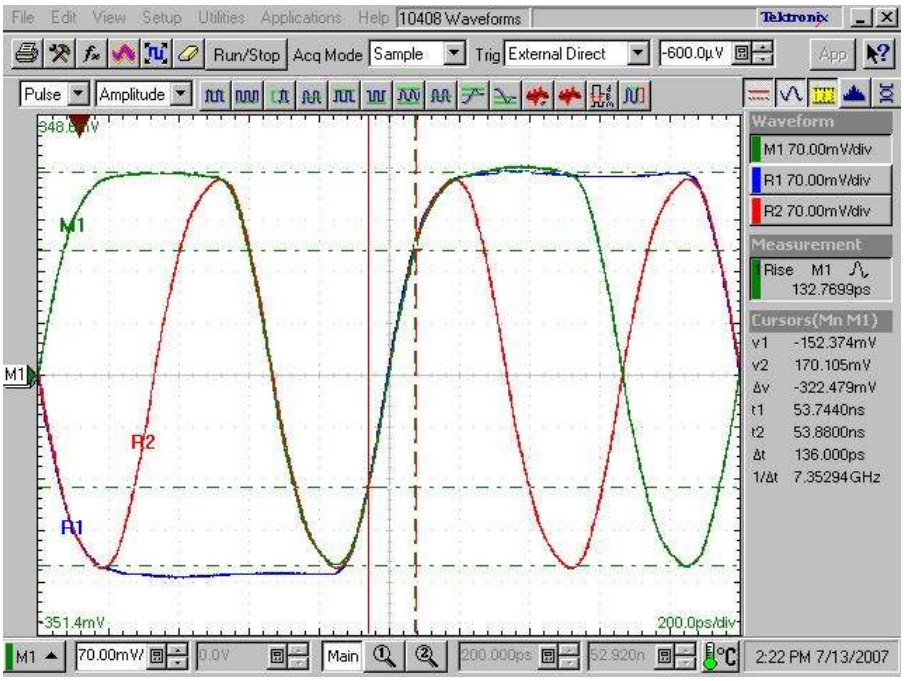
Specify the minimum time span used for the measurement such that the mode amplitude measurements of the 0% and 100% levels are consistent.

Clarify how the edge rise and fall time measurements are qualified or combined.

1.3 Background Information

The goal of controlling the minimum rise and fall time on a signal is to limit the time rate of change of voltage of the transition such that the additional DDJ produced by impedance discontinuities in the transmission channel is limited. The spectrum of the EMI, in the presence of differential imbalances that create a common mode signal, is also affected by the rise and fall times. The measurement of rise and fall time is an industry accepted method of controlling this rate of change and the measurement method is readily available on many forms of test equipment.

The present test patterns include the HFTP, LFTP, and the LBP. The mode amplitude measurement of 0% and 100% reference levels can vary depending on the pattern and analysis zone, even though the time rate of change of voltage of the transition between the 20% and 80% levels are identical. The following picture shows an example.



In the picture above, the LFTP (blue), the HFTP (red) and the LBP (green) are overlaid for comparison. It can be seen that the actual time for the transition to pass from the 20% level to the 80% level is the same. The present active measurement is on the LBP (green). The measurement annotation lines show the 0%, 20%, 80%, and 100% levels. It can be seen that the LFTP and the HFTP would have different 0% and 100% levels and produce different rise and fall time reported values, even though the true rise time is identical in the three waveforms. Rise time measurements varied from 125ps to 134ps if performed on all patterns all edges with an arbitrary analysis zone. (127ps to 134ps on the LPB alone) The LFTP with an 8 UI analysis zone reported 129 ps.

The LFTP also provides a sufficient length of a constant level after a 1 UI initial emphasis zone in which the mode amplitude can measure the 0% and 100% reference levels. By specifying an 8 UI minimum time length analysis zone, the measurement can be performed on edge triggered or clock recovery based measurement system without changes to the reference levels. The waveform display repeats after 8 UI on an edge triggered measurement.

2 Technical Specification Changes

2.1 Rise and Fall Time Measurement Section

[**Editor's Note:** The changes marked in red (and underlined/strikethrough) will be incorporated in section 7.4.3]

7.4.3 Rise and Fall Times

The rise and fall times of the waveform under test are defined over a 20%-80% output level change from the High and Low reference levels. High Reference level of the waveform under test is the "mode" of the top portion while the Low Reference level is the "mode" of the bottom portion. Mode is measured using Statistical Methods of the desired waveform and is the most common value of the probability density function. The minimum time span of the analysis zone for measuring the mode amplitude shall be 8 UI.

Therefore, Rise Time = X2 - X1; where X2 is the mean horizontal time value corresponding to 80% of the distance between the Low and High value and X1 is the mean horizontal time value position corresponding to 20% of the distance between the Low and High value.

And Fall Time = X1 - X2; where X1 is the mean horizontal time value corresponding to 20% of the distance between the Low and High value and X2 is the mean horizontal time value position corresponding to 80% of the distance between the Low and High value.

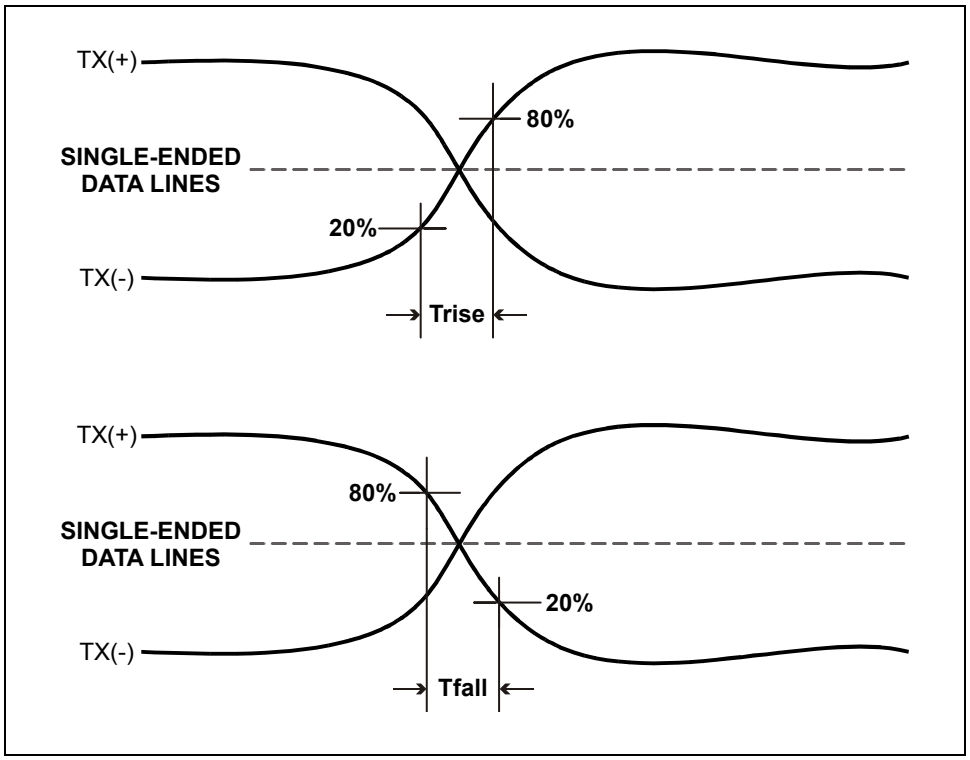


Figure 130 – Single Ended Rise and Fall Time

Rise and Fall values are measured using the ~~HFTP,~~ LFTP~~, and Lone Bit~~ Pattern~~s~~ ~~(LBP)~~ previously defined. The average rise time of all rising edges and the separate average fall time of all falling edges within the 8 UI analysis zone shall both meet the required rise and fall time compliance limits.

The rise and fall times for transmitter differential buffer lines are measured with the load fixture shown in Figure 131. The rise and fall times shall be measured with an HBWS.