Determining First Pulse Attenuation

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3/2/01 adaptec
Managing Output Driver Power

• PCI-X is looking at increase speed or a possible increased bus loading, but mostly increased speed.

• PCI-X power dissipation can double, because of the above

• Need to insure that we haven’t ‘over’ worst cased the SCSI driver.
Creating a 1st pulse model

- Determine cable attenuation vs. frequency
- Create Hspice W element cable model that matches frequency roll off characteristics.
- Find cable length for 12db loss @ 200MHz
- Sweep cable length, and display result such that 12db loss @ 200MHz is 100% point of the X-axis
185mV holding level assumptions

- Eye mask has always allowed for dips to 30mV.
- 60mV X-talk is not likely because, if it is on a quite output from the driving side, then 22mV is the X-talk.
- If you consider X-talk on the clock that is flowing in the direction against the data, there is always at least 1 quiet signal right next to it on one side, and many quiet signals on the other side.
- Anyway, if you add 30mV + 60mV, plus allow 95mV for more than 25% reflections, = 185mV.
- 185mV holding is after any driver or system offset.
If 0.60 is the roll off measured,
then 0.76 is the 1st pulse attenuation

\[
0.76 \times (370 + 185) = 421.8
\]

\[
\frac{421.8 - 185}{236.8 \text{ mV}} - 60 \text{ mV system noise} = 176.8 \text{ mV}
\]
Old model

0.60 is the roll off measure on systems

500mV

150mV

875mV

525

-375

\[
\frac{525}{150 \text{ mV}} \quad \frac{-375}{-60 \text{ mV SYSTEM noise}}
\]

90 mV
normalized cable length for maximum attenuation of 12 db @ 200 MHz

signal attenuation @ 80 MHz

- Precomp
- Pipe
- Free
Voltage level in table represents ~3ns signal width

<table>
<thead>
<tr>
<th>Cable roll off to 60% signal -60 mV crosstalk &amp; Noise</th>
<th>23% DC loss from cable, connectors and terminators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trans FB 22% roll off to 60%</td>
<td>103.19072 149.5016 158.3227 160.528 186.9914 213.4547 248.7392 266.3814 292.8448</td>
</tr>
<tr>
<td>Trans FB 33% roll off to 60%</td>
<td>111.39584 160.0352 169.2998 171.616 199.4099 227.2038 264.2624 282.7917 310.5956</td>
</tr>
<tr>
<td>Trans FB 40% roll off to 60%</td>
<td>115.4984 165.302 174.7884 177.16 205.6192 234.0784 272.024 290.9968 319.456</td>
</tr>
<tr>
<td>Trans FB 50% roll off to 60%</td>
<td>122.336 174.08 183.936 186.4 215.968 245.536 284.96 304.672 334.24</td>
</tr>
</tbody>
</table>

Right equation: $(((V+VFB)^{0.76}Vfb)^{0.77}-60)$

100 mV receiver required, 60 mV Crossstalk and System Noise
In Closing

- Free running attenuation is much greater than 1st pulse attenuation.
- There was no need for such a high holding level after pre-comp cutback.
- Let each company decide it’s own driver output offset budget.

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Table A.2 - Driver steady-state test limits and conditions for synchronous, non-paced transfers

<table>
<thead>
<tr>
<th>Test parameter</th>
<th>Test conditions (figure A.1)(note 1)</th>
<th>Minimum (mV) (note 2)</th>
<th>Maximum (mV)</th>
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<td>$</td>
<td>V_A</td>
<td>$ Differential output voltage magnitude (asserted) (note)</td>
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<td>$V_1 = 1,056 \text{ V} \quad V_2 = 0,634 \text{ V}$</td>
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<tr>
<td>All four above conditions</td>
<td>$0,69 \times</td>
<td>V_N</td>
<td>+ 50$</td>
</tr>
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</table>

Notes:
1 The test circuit (figure A.1) is approximately equivalent to two terminators creating the normal system bias.
2 Minimum standard drive level. If there is a pre-comp cutback, then the minimum drive level after cutback must be greater than 185mV after all system & driver offsets are taken into account.
3 The test limits shall be within the shaded area of figure A.2.

Table A.3 - Driver steady-state test limits and conditions for paced transfers

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<td>$</td>
<td>V_A</td>
<td>$ Differential output voltage magnitude (asserted)</td>
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</tr>
<tr>
<td>All four above conditions</td>
<td>$0,90 \times</td>
<td>V_N</td>
<td>- 23$</td>
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Notes:
1 The test circuit (figure A.1) is approximately equivalent to two terminators creating the normal system bias.
2 Minimum standard drive level. If there is a pre-comp cutback, then the minimum drive level after cutback must be greater than 185mV after all system & driver offsets are taken into account.
3 The test limits shall be within the shaded area of figure A.3.