Design Review
Comparator
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OUTLINE

• Comparator Basic Function
• Architecture
• General Working of Architecture
• Corner Cases
• Offset Calculation
• Issues
• To Do Things
• Conclusion
Comparator Basics

<table>
<thead>
<tr>
<th>If $V_i/p &gt; V_{ref}$</th>
<th>$V_{out} = 1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>If $V_i/p &lt; V_{ref}$</td>
<td>$V_{out} = 0$</td>
</tr>
</tbody>
</table>

- My design uses Phi 1 advance for comparator and Phi 2 advance for Lockout
- Comparator starts on negative edge of Phi 1 Advance
- Lockout starts on the positive edge of Phi 2 Advance
List of Specifications

- Comparator should make decision in Non-overlap time of 3ns
- Offset below 100mv
Architecture
Comp making decision
LOCK
OUT

PHi-2'
posedge
CORNER CASES

• Time for change of i/p after the clock edge.
• 1mV diff
Corner Case 1
A – B = 500 ps
Corner Case 2 (1mv Diff)
<table>
<thead>
<tr>
<th></th>
<th>5.5V</th>
<th>5.0V</th>
<th>4.5V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0°C</td>
<td>27°C</td>
<td>85°C</td>
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<tr>
<td></td>
<td>0°C</td>
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<tr>
<td></td>
<td>0°C</td>
<td>27°C</td>
<td>85°C</td>
</tr>
<tr>
<td>TT</td>
<td>1.41ns</td>
<td>1.59ns</td>
<td>1.68ns</td>
</tr>
<tr>
<td>SS</td>
<td>1.71ns</td>
<td>1.80ns</td>
<td>1.90ns</td>
</tr>
<tr>
<td>FF</td>
<td>1.40ns</td>
<td>1.41ns</td>
<td>1.35ns</td>
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<tr>
<td>FS</td>
<td>1.47ns</td>
<td>1.70ns</td>
<td>1.72ns</td>
</tr>
<tr>
<td>SF</td>
<td>1.42ns</td>
<td>1.48ns</td>
<td>1.67ns</td>
</tr>
</tbody>
</table>

**Sims shown**

**Typical case**

**Best Case**

**Worst case**
Sims for Normal Supply, Low Temp and SS
Offset Calculations

• Using Pelgrrom Numbers
  – I found it to be 47mv
• Using Test Bench provided by Dr. Matthews
Test Bench For Offset Calculation

VCCS with gain 10Mmho

VCVS with gain 1

VCVS with gain 1
I/P < -0.25 => 0 0 0 0
-0.25 < I/P < 0.25 => 0 1 0 1
I/P > 0.25 => 1 1 1 0
To Do

- To emphasize on Device Sizes if necessary
- Solve all the issues that come up in this review
- Start with the Layout when all the issues are resolved
Conclusion

• Comparator decides well within the non-overlap time (even considering the worst case)

• Offset due to mismatch is 47mv. Hence, even if my dynamic offset is higher, I would be well under the 100mv limit given to me.