LAB10 – HIGH SPEED COMPARATOR DESIGN

Overview:

The objective of this laboratory is to design an open loop comparator that will meet a given set of specifications.

The steps in the laboratory are:

- Specifications
- Approach
- Simulation/Test Benches
- Tips and Tricks

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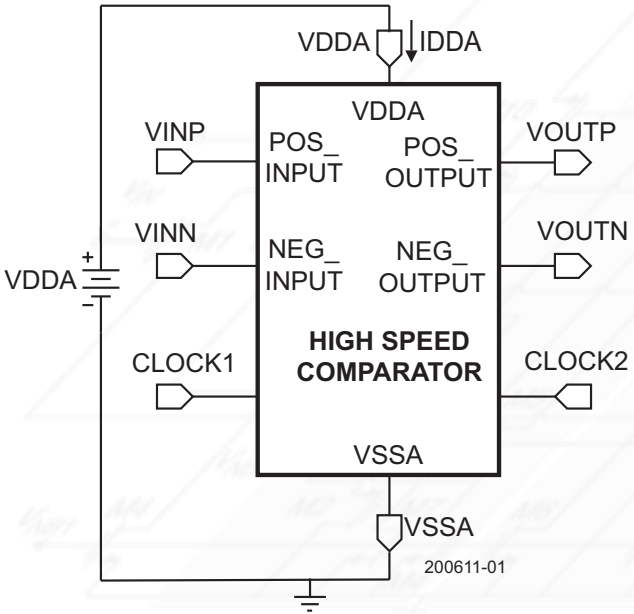
Lab10 - Specifications

Specifications

Technology - xFab XH035B

Block diagram:



Parameter	Symbol	Min	Typ	Max	Units
Power Supply Voltage	VDDA	3	3.3	3.6	V
Ground	VSSA	0	0	0	V
Bulk Bias Voltage	VBBA	0	0	0	V
Junction Temperature	TJ		27		°C

Note: You are only responsible for the circuits within the box labelled **HIGH SPEED COMPARATOR**

Lab10 - Specifications

Specifications – Continued

(VDDA = 3.3V, TJ = 27°C, C_L = 1pF on each output to ground)

Parameter	Symbol	Condition	Min	Typ	Max	Units
Bias Current for total circuit	IDDA	VDDA = 3.3V, VICM=1.65V			300	µA
Upper Output Voltage	V_{OH}		3			V
Lower Output Voltage	V_{OL}				0.3	V
Minimum Input Voltage	V_{in}(min)				1	mV
Maximum Frequency of Operation	f_{op}		200			MHz
Propagation Time Delay	t_p	Step input of V_{in}(min)			2.5	ns
Readout Time	t_{read}				2.5	ns
Clock rise and fall times	t_{fclock}				100	ps
Clock voltages	V_{clock}				4	V

Test Bench 1

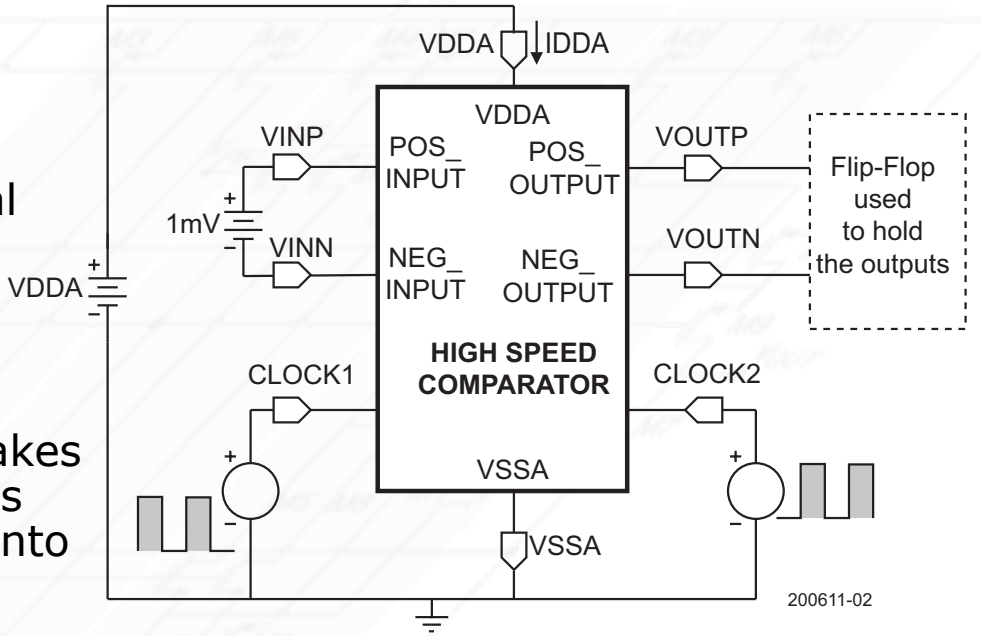
IDDA - DC OP

This Test Bench does the following:

1.) Determines IDDA for nominal model, tm

2.) Response of the high-speed comparator to the 1mV input.

3.) The high-speed comparator should be designed so that it makes a comparison in 2.5ns and allows 2.5ns for the output to be read into a flip-flop for a frequency of operation of 200MHz.



Electrical Design

Steps

1. Choose one of the appropriate design procedures
2. Hand design using the design procedure
3. Build the test bench to determine the performance of your design
4. After you have used the test benches provided to simulate your circuit, download the Lab Data Entry worksheet of Lab10.
5. If you did not meet specifications, you are encouraged to modify your circuit in order to meet the specifications

Tips and Tricks

Helpful Ideas for Lab10

1. It is assumed that clocks will be used for this laboratory. The switches are to be MOS transistors designed to function correctly in the given application.
2. Connect the bulks of all NMOS switches to VSSA and the bulks of all PMOS switches to VDDA.
3. Use NMOS switches since the clock magnitude exceeds VDDA.

Performing Lab10

Instructions

1. Go to efabless.com
2. Register using your LinkedIn account (get one if you don't already have one)
3. Agree to the terms
4. Receive approval to access the efabless platform by email
5. Use Electric to create your design and NGSpice to perform simulation.
6. Download a copy of the Lab10 Data Entry Worksheet from the following link or from the link on the course page.

https://www.dropbox.com/s/t4oh1jiell1vm1g/LabXX_Data_Entry_Worksheet1.xlsx?dl=0

Complete the entries in the Worksheet including your name and email and send it to Dr. Allen at pallen@ece.gatech.edu and I will send you my solution for the lab.

Help with Electric and NGSpice

Videos

The following two lessons provide examples of how to use Electric for schematic capture and NGSpice and SymProbe for simulation and viewing.

Lesson 7 – How to Use Electric

Lesson 8 – How to Use NGSpice

Summary – Lab10

High-Speed Comparator Design

- Understand the lab specifications
- Selection of an appropriate design procedure and topology
- Develop the design using the design procedure
- Build the test benches to simulate and determine performance
- Modify as necessary and submit the data entry sheet
- Obtain a copy of the lab solution