Ring oscillator

Part 1

3. Measure the gate delay of the NOT gate.

Rise/fall time = 0.1 ns

tpLH = 280ps

tpHL = 430ps

gate delay = (280 + 430)/2 = 355ps

A graph on a black background

Description automatically generated

4. How do you justify your reading?

5. Why the PMOS transistor W is selected almost twice than that of NMOS transistor?

6. Observe the effect by setting the same W (100u) for both PMOS and NMOS transistors.

A screen shot of a graph

Description automatically generated

tpLH = 337ps

tpHL = 315ps

Part 2

2. Gate delay

tpLH = 287ps

tpHL = 444ps

gate delay = 365.5ps

A screen shot of a computer

Description automatically generated

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| --- | --- | --- | --- | --- | --- | --- |
| NMOS | PMOS | tpLH | tpHL | Delay | Rise time | Fall time |
| 10, 100 | 10, 200 |  |  | 365.5 | 747ps | 750ps |
| 10, 100 | 10, 100 | 356.4 | 356.4 | 356.4 | 766ps | 700ps |
| 10, 50 | 10, 100 | 294 | 454 |  | 762 | 762 |
| 15, 100 | 15, 200 | 560 | 945 |  | 1676 | 1645 |
| 5, 100 | 5, 200 | 111 | 156 |  | 210 | 217 |
| 10, 150 | 10, 300 | 263 | 441 |  | 767 | 777 |

Part 3

A screen shot of a computer

Description automatically generated

A screen shot of a computer

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Fall time = 1.52ns

Rise time = 2.27ns

VCO

5)

|  |  |  |  |
| --- | --- | --- | --- |
| VCP | VCN | Period | Frequency |
| 3.52 | 1.48 | 1046 | 0.956 |
| 3.43 | 1.57 | 770.8 | 1.297 |
| 3.3 | 1.66 | 573.2 ns | 1.745 MHz |
| 3.22 | 1.78 | 429 ns | 2.33 M |
| 3.08 | 1.92 | 324 | 3.086 |
| 2.91 | 2.08 | 248 | 4.032 |
| 2.74 | 2.26 | 193.8 | 5.16 |
| 2.5 | 2.5 | 154.7 | 6.464 |

A screenshot of a computer

Description automatically generated

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