

Experiment 1: Characterization of a CMOS Inverter

Devesh Kumar 16d070044

January 13, 2018

- 1 Plot the transfer characteristics of inverter and tabulate the input and corresponding output voltages. Find the switching point on the transfer characteristic.

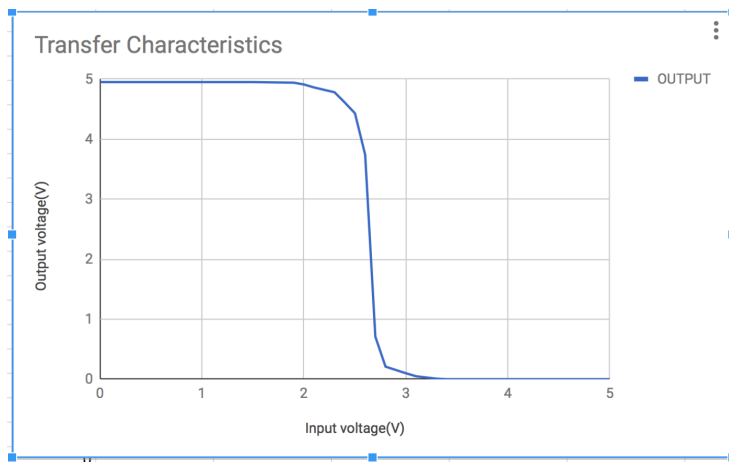


figure : transfer characteristic

Input Voltage	output Voltage
0	4.95
0.4	4.95
0.7	4.95
0.9	4.95
1.5	4.95
1.9	4.94
2	4.91
2.1	4.86
2.3	4.78
2.4	4.61
2.5	4.43
2.6	3.74
2.7	0.71
2.8	0.21
3	0.1
3.1	0.05
3.2	0.03
3.3	0.01
3.4	0
4	0
5	0

switching point is :2.5 V

- 2 Part 2: 2. Plot the output characteristics of the inverter in the two cases: output- high and output-low. Tabulate the input and corresponding output voltages for both the cases.

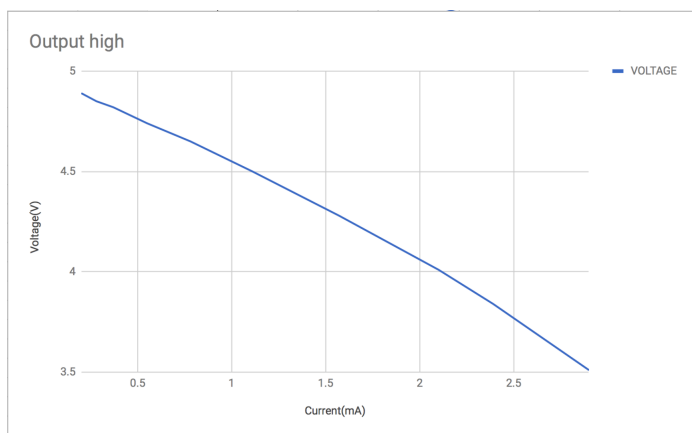
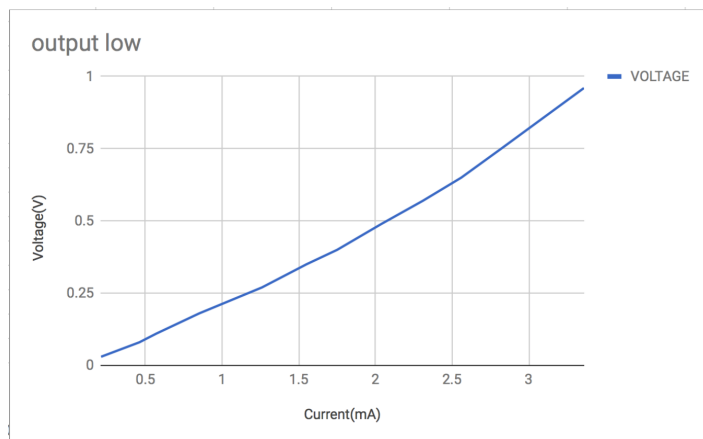


figure : output high

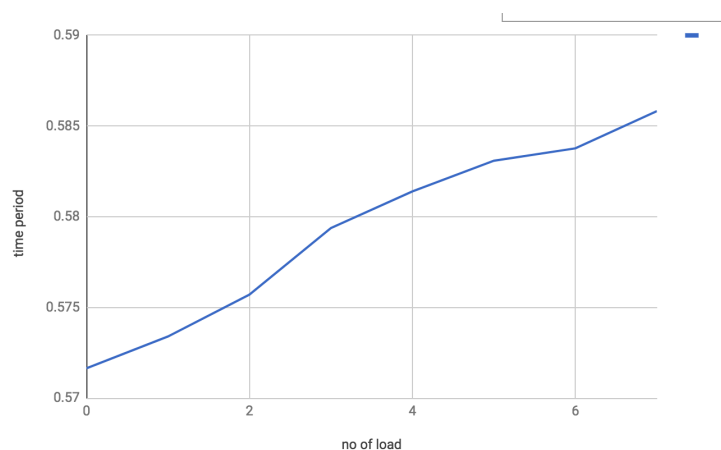
current(mA)	Voltage(v)
0.2	4.89
0.28	4.85
0.37	4.82
0.55	4.74
0.78	4.65
1.11	4.5
1.57	4.28
2.1	4.01
2.39	3.84
2.9	3.51



current(mA)	Voltage(v)
0.21	0.03
0.36	0.06
0.46	0.08
0.57	0.11
0.85	0.18
1.26	0.27
1.55	0.35
1.75	0.4
2.04	0.49
2.31	0.57
2.56	0.65
2.82	0.75
3.36	0.96

figure : output low

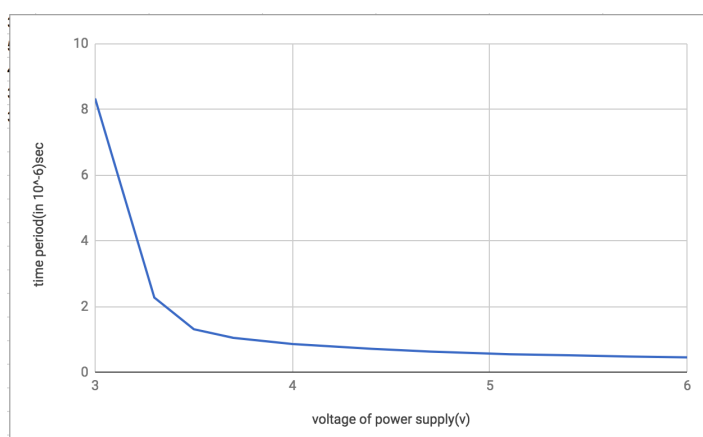
- 3 Part 3: Plot the oscillation period of the ring oscillator as a function of the load at the output. Find pinv and . A snap-shot of the DSO (get help from Laboratory staff if you do not have a camera) showing the ring-oscillator output with load = 2 should also be included in the report.**



No. of load	time period($10^{-6}sec$)
0	0.5716402392
1	0.5724098454
2	0.5757052389
3	0.5793742758
4	0.5813953488
5	0.583090379
6	0.5837711617
7	0.5858230814

slope = $t = 0.002087377624 \times 10^{-6}sec$ $Pin = 7.247774223$

- 4 Plot the ring oscillator period as a function of the power supply voltage (varied from 3V to 6V). Record your observations in a table. How does the delay vary with the power supply voltage?**



power supply voltage	time period($10^{-6}sec$)
6	0.456412597
5.7	0.4830917874
5.4	0.5208333333
5.1	0.5540166205
5	0.5743825388
4.7	0.634115409
4.4	0.7178750897
4	0.8643042351
3.7	1.052631579
3.5	1.314060447
3.3	2.277904328
3	8.333333333

The time period and the power supply vary inversely with each other i.e. $t = c \cdot 1/v_{dd}$

- 5 Observe the power-supply current drawn by the ring oscillator. Measure the peak and average value. Include a snapshot of the DSO measurement.

