

Experiment No. 1

Familiarization of Hardware setup

Run 1: Understanding the trainer board (20 mins)

The power supply is a source of regulated DC power. It is used to power different ICs. It is also used to provide logic level inputs to different digital circuits. Below are the tasks to perform:

- (a) Connection of inputs to output LEDs
- (b) Manual clock to LEDs

Q: Why is it called multi-output supply?

A: Because they provide both AC and DC.

Q: Which amongst the outputs of the power supply would you choose for digital IC based experiments? Why?

A: DC

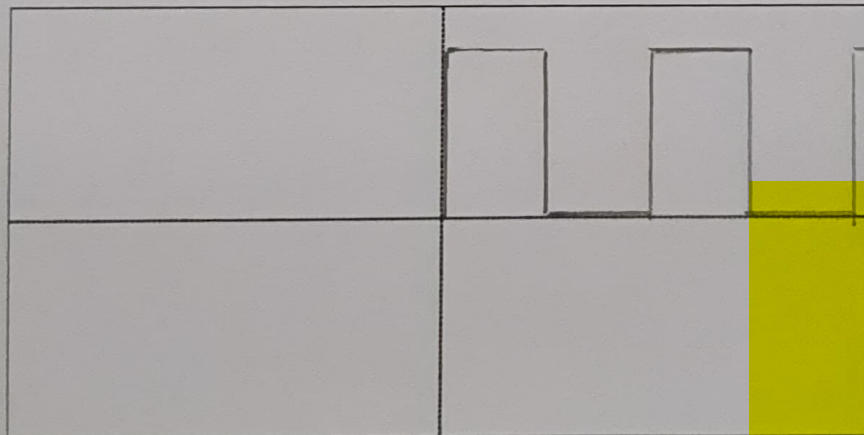
Run 2: Understanding the CRO (20 Mins)

The CRO is the most useful and versatile electronic test equipment. It lets us see voltage in a circuit as a function of time, triggering on a particular point of the waveform so that a stationary display result. Below are the tasks to perform:

- (a) Connect and see the test square waveform from CRO itself
- (b) Connect and see the square wave from trainer board to CRO (vary frequency)

Q: Draw the test square waveform generate by CRO itself. What is the voltage and frequency of this waveform?

A:



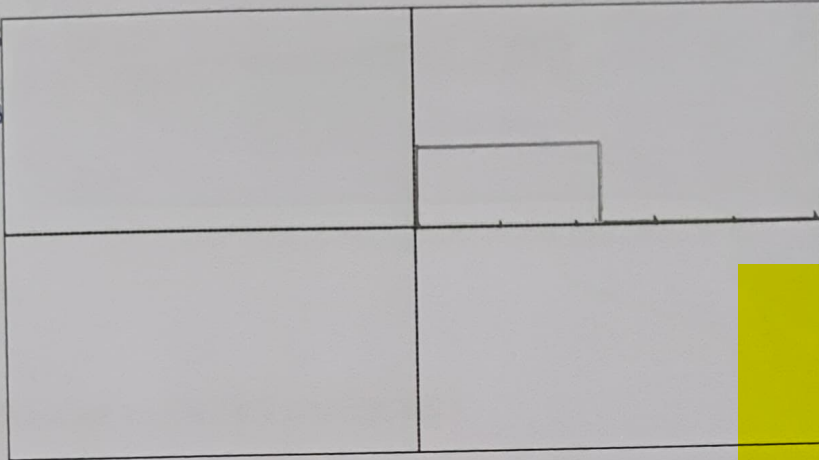
$$\begin{aligned}\text{Voltage} &= 1\text{V} \\ \text{Time Period} &= 0.25\text{ms} \\ \text{Frequency} &= 1/0.25 \times 10^{-3} \\ &= 4 \times 10^3\text{Hz}\end{aligned}$$

$$\begin{aligned}\text{Amplitude} &= 2 \times 1 \\ &= 2\text{V} \\ \text{No. of divisions on x-axis} &= 5 \text{ divisions}\end{aligned}$$

Q: Generate a square wave of 5 V from TTL O/P of Function Generator, 1KHz from trainer board to CRO. Calculate its time period and Draw the waveform? Draw another wave form with 2KHz frequency.

A:

$$\begin{aligned}\text{Time Period} &= 0.125 \text{ ms} \\ \text{Frequency} &= 1 / 0.125 \times 10^{-3} \\ &= 8 \times 10^3 \text{ Hz} \\ \text{Amplitude} &= 0.9 \times 5 \\ &= 4.5 \text{ V} \\ \text{No. of divisions} &= 2.5\end{aligned}$$



$$\begin{aligned}2 \text{ KHz} \\ \text{Time Period} &= 1.2 \text{ ms} \\ \text{Frequency} &= 1 / 1.2 \times 10^{-3} \\ &= 0.83 \times 10^3 \text{ Hz} \\ \text{Amplitude} &= 4.5 \text{ V} \\ \text{No. of divisions} &= 2.4\end{aligned}$$

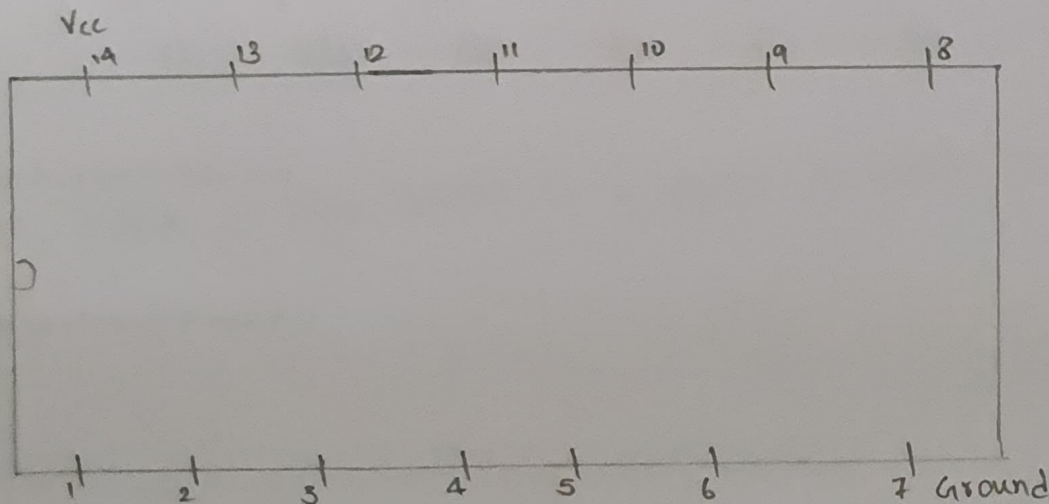
Run 3: Understanding the IC data sheet of NOT Gate (20 mins)

Refer Appendix-II for IC Data Sheet

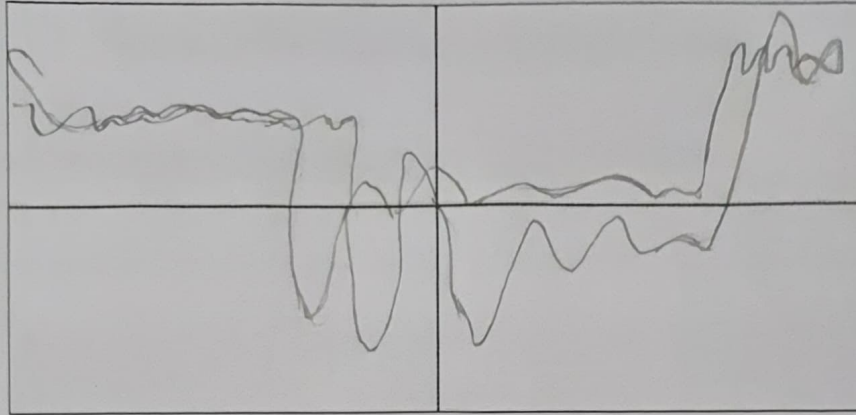
- Pin Diagram
- Voltage nominal +/- tolerance
- Logic low range
- Logic high range
- Gate delay

Q: Write is the IC no. of NOT Gate? Draw its Pin Diagram?

A:



Input and output:



Q: Note down the tPHL and tPLH and calculate the propagation delay of each gate?

A:

Input clock frequency:

tPHL: $0.3 \mu s$

tPLH: $0.4 \mu s$

Average propagation delay (P.D) = $(tPHL + tPLH)/2 = 0.7/2 = 0.35 \mu s$

Delay per gate = $P.D/6$
 $= 0.058 \mu s$

Assignment:

1. How do you test if a CRO is working or not? A square waveform is generated with the ground terminal.
2. What is the meaning of the following IC packages type –SOIC and PDIP?

SOIC – Surface mount integrated circuit package
PDIP – plastic dual inline package

Test yourself

1. What is a sweep signal in a CRO and how is it relevant in triggering?
2. Where is a component tester located in the CRO and what are its applications?
3. What is significance of the ac/dc switch in the CRO?
4. What is the use of an external trigger in a pulse generator?
5. What is the cable that you use for connecting the CRO to signal point called?
6. What is the connector between the cable and the CRO called?