

Circuit Simulation Project

<https://esim.fossee.in/circuit-simulation-project>

Name of the participant: Shweta Umesh Khune

Title of the circuit: Design and Simulation of TS391 Single Comparator IC

Theory:

The TS391 IC is a low-power, single-voltage comparator designed for a variety of applications requiring precise voltage monitoring. It operates with a low supply current, making it ideal for battery-powered devices and energy-efficient systems. The IC features an open-drain output, allowing it to interface easily with different logic levels and enabling wired-AND configurations. Applications of the TS391 include voltage level detection, battery monitoring, and over-voltage protection circuits. It is also used in pulse-width modulation (PWM) controllers, signal conditioning, and threshold detectors.

Advantages of the TS391 IC include its low power consumption, which extends battery life in portable devices. Its wide operating voltage range enhances versatility across different designs. The open-drain output provides flexibility in interfacing with various digital systems. Additionally, the IC's low input offset voltage ensures high accuracy in voltage comparison tasks, making it suitable for precision monitoring and control applications.

DC Input Voltage: The DC input voltage is applied to the input of the comparator circuit.

DC Output Voltage: The DC output will get in non-inverting form.

1. Schematic Diagram :

The circuit schematic of TS391 Single-Comparator IC in eSim is as shown below:

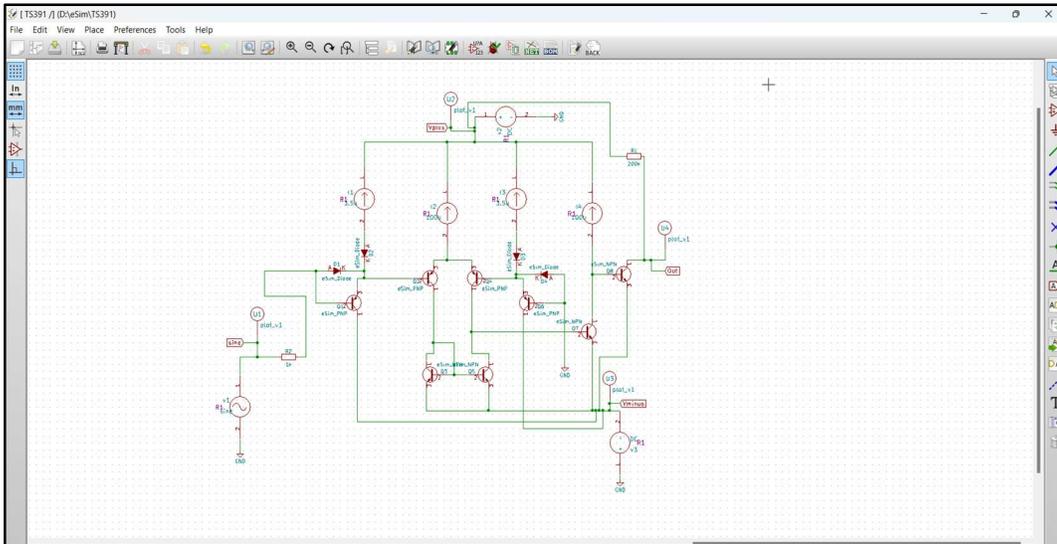


Figure 1: Circuit schematic of TS391 Single Comparator IC

2. Transient Analysis Parameter are as below:

Analysis Source Details Ngspice Model Device Modeling Subcircuits

Select Analysis Type

AC DC TRANSIENT

Transient Analysis

Start Time 0 sec

Step Time 0.01 ms

Stop Time 100 ms

Convert

Analysis Source Details Ngspice Model Device Modeling Subcircuits

Add parameters for DC source v3

Enter value (Volts/Amps):

Add parameters for DC source v2

Enter value (Volts/Amps):

Add parameters for sine source v1

Enter offset value (Volts/Amps):

Enter amplitude (Volts/Amps):

Enter frequency (Hz):

Enter delay time (seconds):

Enter damping factor (1/seconds):

Convert

Figure 2: DC Source V1, V2 and V3

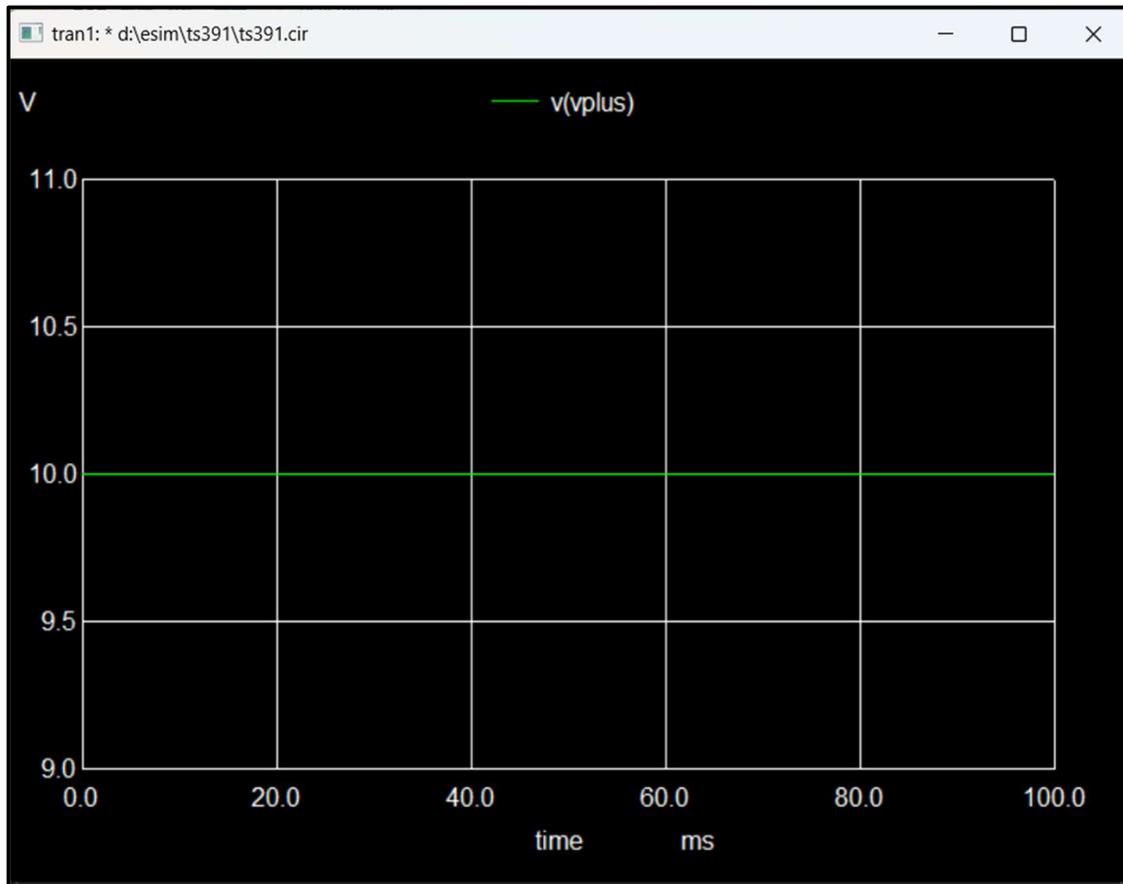


Figure 3: Ngspice Input Voltage plot

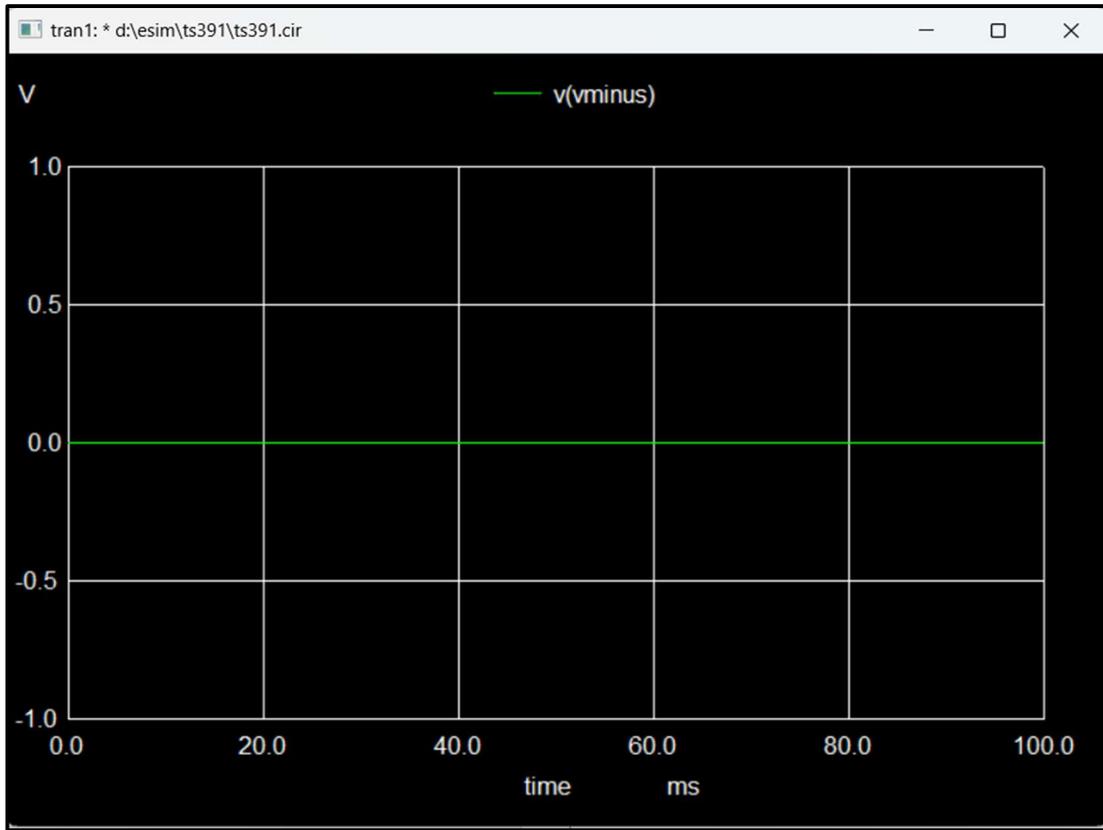


Figure 4: Ngspice Input Voltage Plot

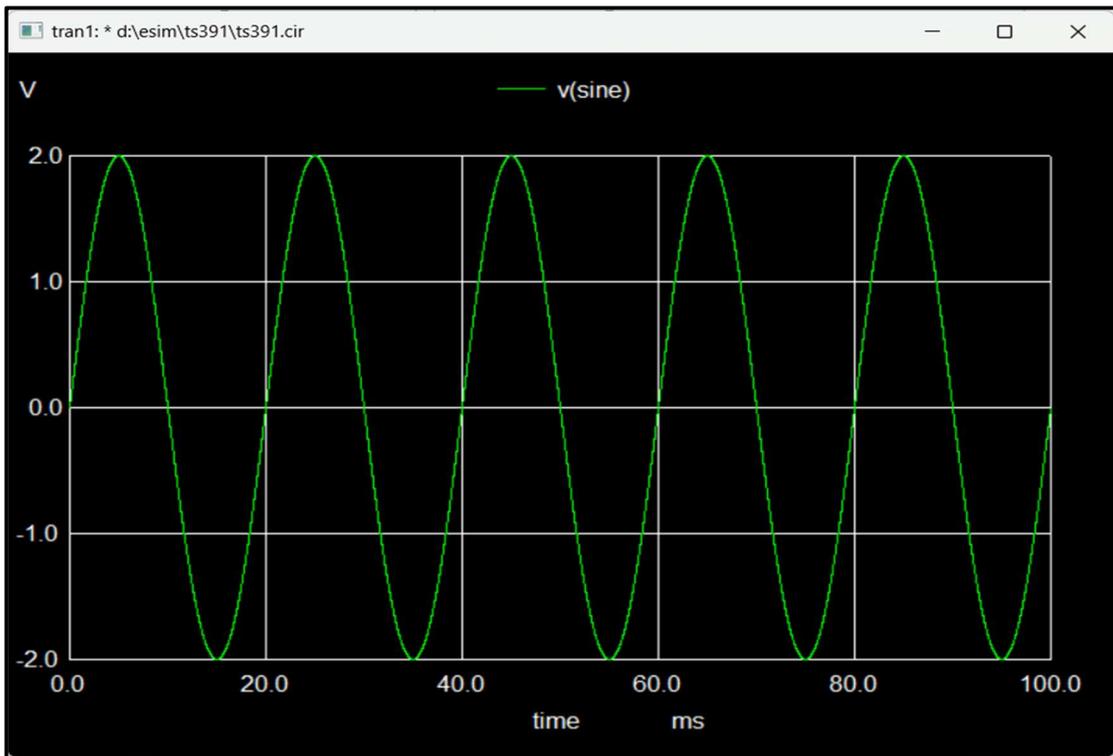


Figure 5: Ngspice Input Voltage Plot

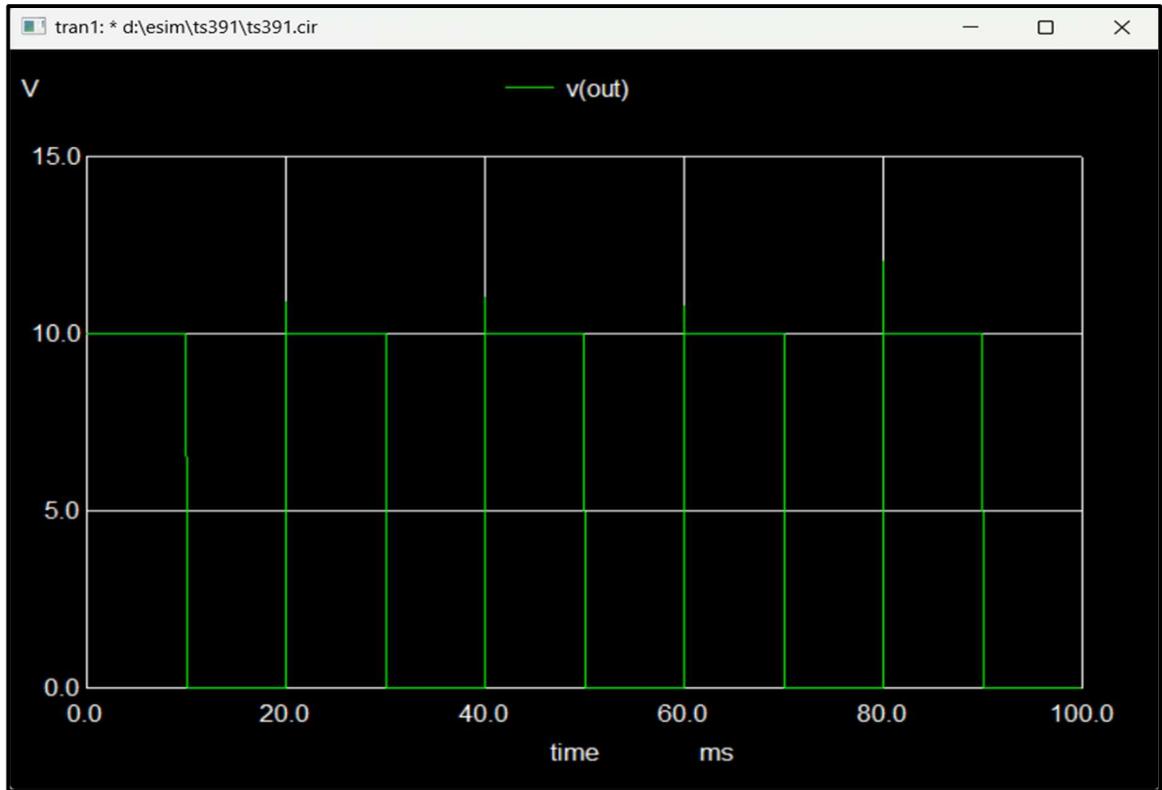


Figure 6: Ngspice Output Voltage Plot

Python Plotting:

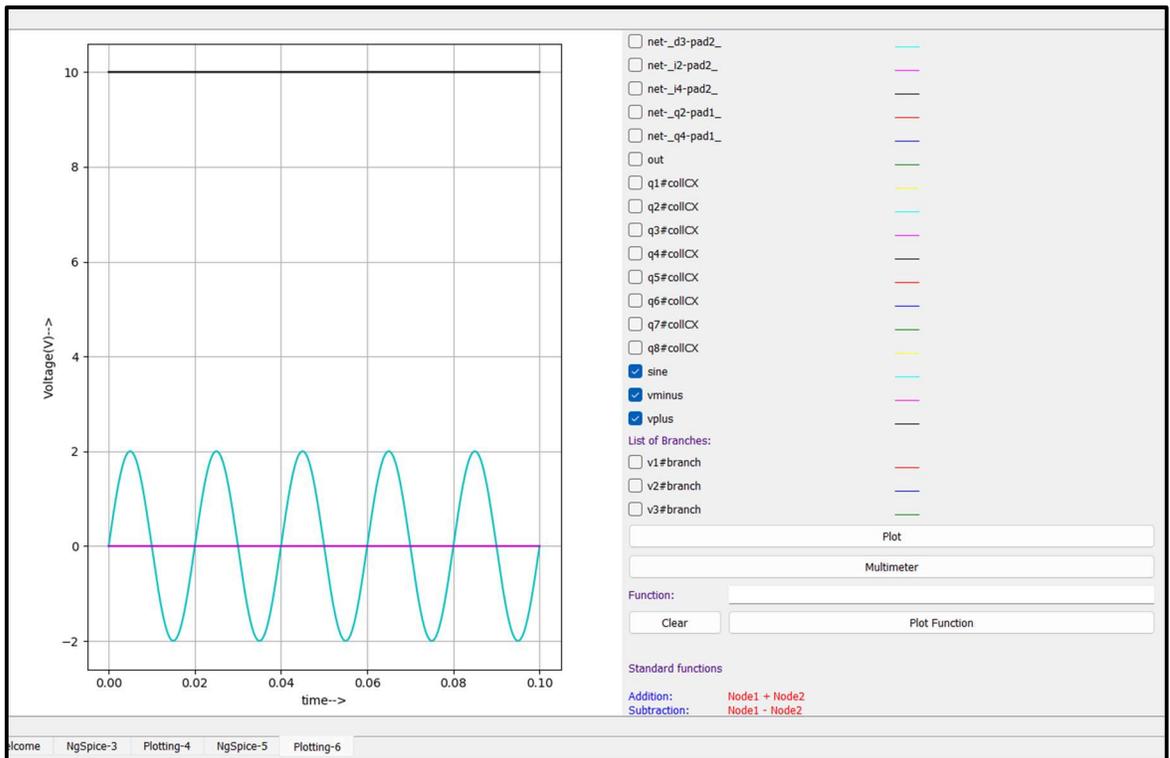


Figure 7: Input Voltage Python Plot

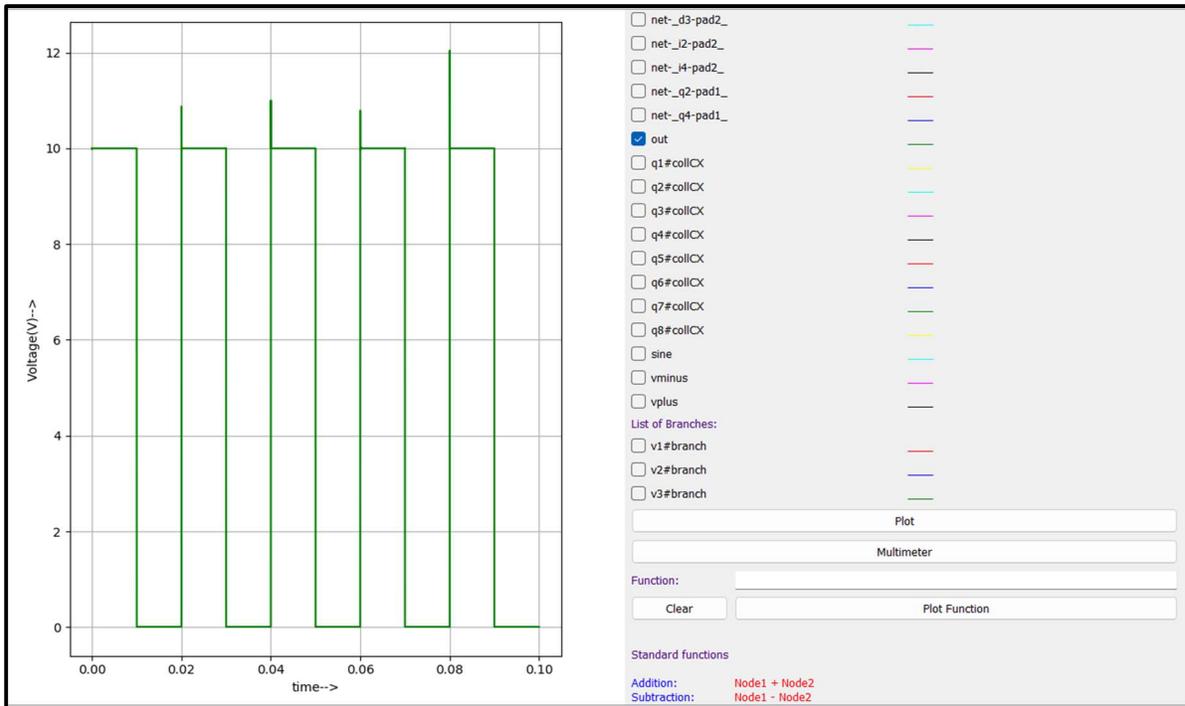


Figure 8: Output Voltage Python Plotting

Conclusion: The design and simulation of the TS391 single comparator IC demonstrate its ability to effectively compare input voltages and provide a clear output transition based on the threshold levels. The simulation confirms stable performance with accurate response times, making it suitable for precision applications. Overall, the TS391 proves reliable for low-power, high-precision voltage comparison tasks.

References: Power Electronics (M D Singh & K B Khanchandani) 2nd Edition (Page No. 545)

