

# **SINE/PULSE WAVE GENERATOR**



## TEAM PRESENTATION



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# 1

## INTRODUCTION

Sine/Pulse wave generator

“ *Design an audio signal generator that produces a sinusoidal output with a variable frequency and amplitude and operates from dc voltages.*

# 2

## THEORY AND SCHEMATIC

2.1 Theory

2.2 Schematic



## Theory

- We will show how to build a wave generator circuit that allows for adjustable frequency and amplitude of the output wave signal.
- This square wave generator circuit can be built simply a 555 timer chip and a few resistors, capacitors, and potentiometer.
- A 555 timer can easily create square waves when in a stable mode of operation. The potentiometer allows us to vary the frequency of the output signal as well as the amplitude.
- Components Needed: 555 Timer Chip, 10k $\Omega$  potentiometer, 1nF capacitor, 1k $\Omega$  and 10k $\Omega$  resistor.



## Theory

■ We will go over the pinout of the 555 timer that can be obtained very cheaply from pretty much any electronic retailer. The 555 timer is an 8-pin chip.



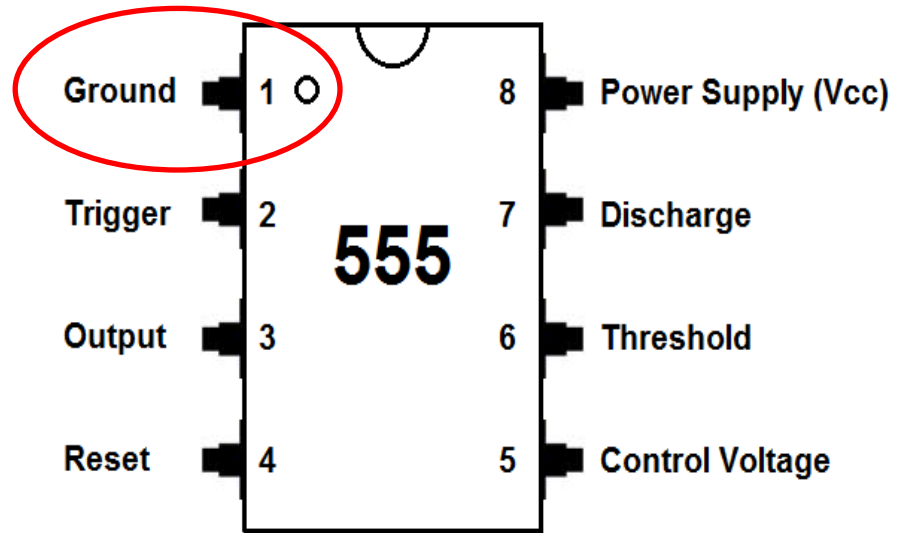
The 555 Timer





## Theory

- Pin 1 connects the 555 timer chip to ground.

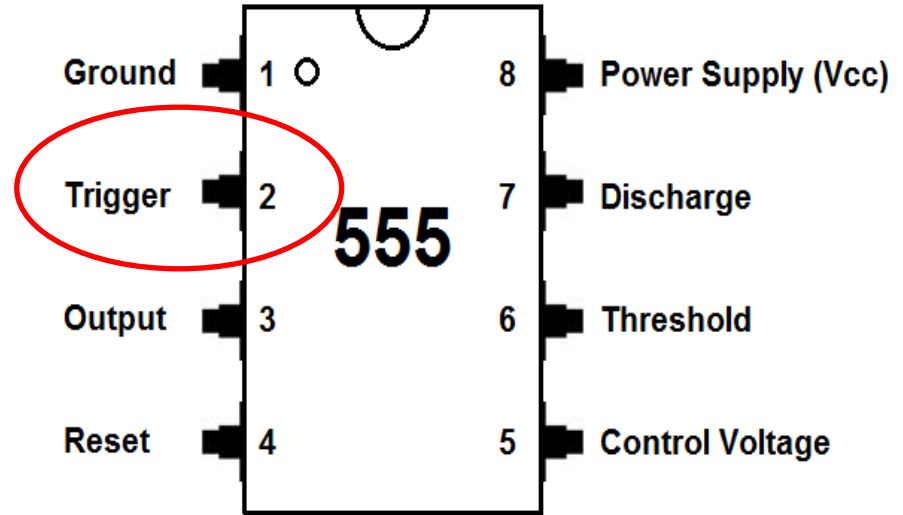


The 555 Timer



## Theory

- Pin 2 works like a starter pistol to start the 555 timer running. The trigger is an active low trigger, which means that the timer starts when voltage on pin 2 drops to below  $1/3$  of the supply voltage.
- When the 555 is triggered via pin 2, the output on pin 3 goes high.

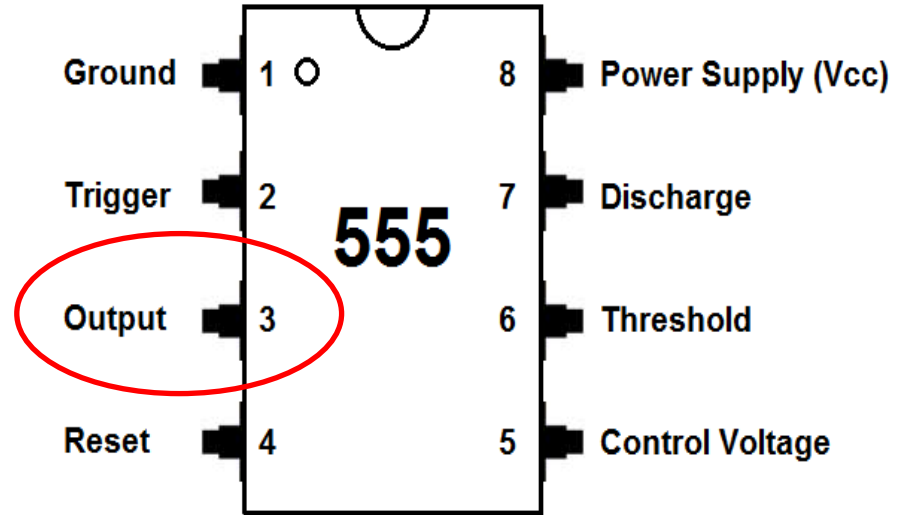


The 555 Timer



## Theory

- 555 timer's output is digital in nature.
- The output is either low (very close to 0V), or high (close to the supply voltage that's placed on pin 8).
- Use to connect the load that you want the 555 timer to power. This may be an LED, for instance.

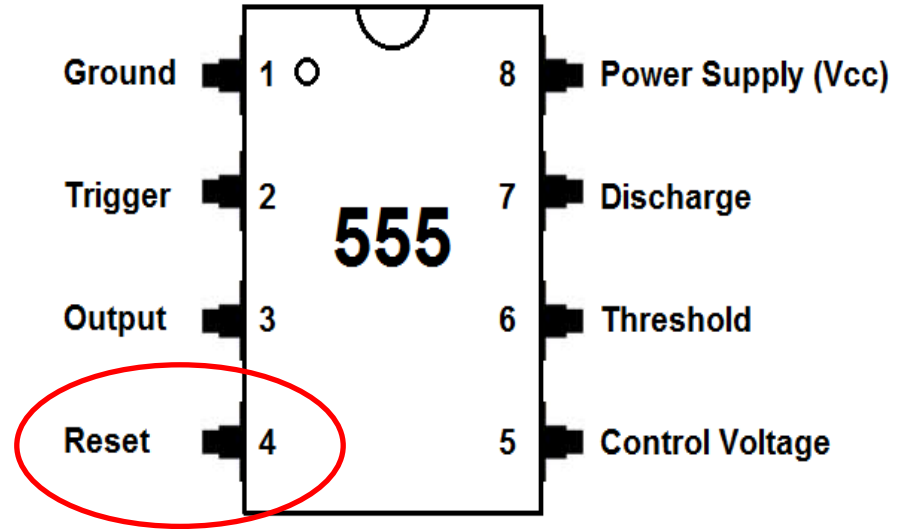


The 555 Timer



## Theory

- Pin 4 can be used to restart the 555 timer's timing operation.
- This is an active low input. Thus, pin 4 must be connected to the supply voltage of the 555 timer to operate.
- If it is momentarily grounded, the 555 timer's operation is interrupted and won't start again until it's triggered again via pin 2.

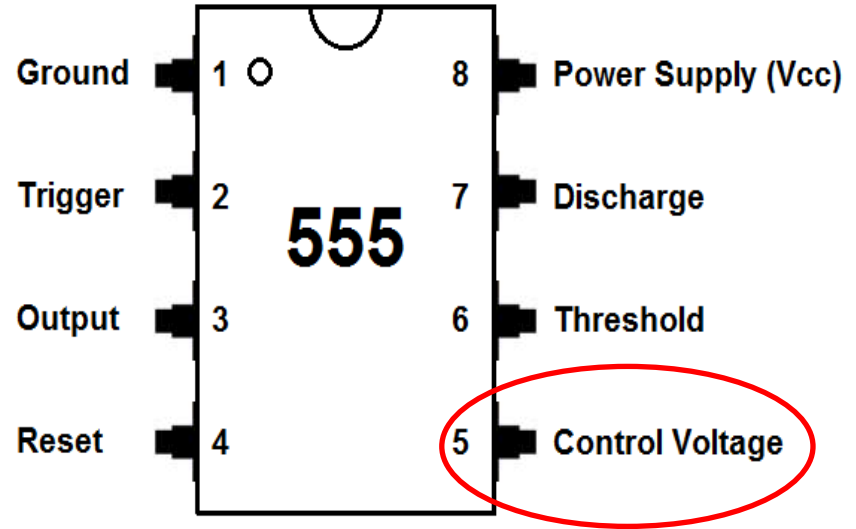


The 555 Timer



## Theory

- Pin 5 is simply connected to ground, usually through a small capacitor ( $\sim 0.01 \mu\text{F}$ ). This capacitor serves to level out any fluctuations in the power supply voltage that might affect the operation of the timer.
- Some circuits (though rare) do use a resistor between the control pin and  $V_{cc}$  to apply a small voltage to pin 5. This voltage alters the threshold voltage, which in turn changes the timing interval.

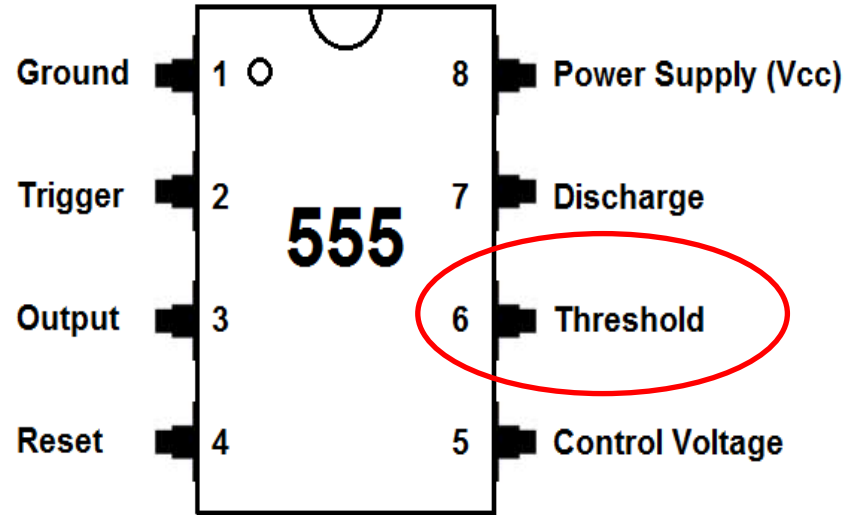


The 555 Timer



## Theory

- The purpose of this pin is to monitor the voltage across the capacitor that's discharged by pin 7.
- When this voltage reaches  $2/3$  of the supply voltage ( $V_{CC}$ ), the timing cycle ends, and the output on pin 3 goes low.

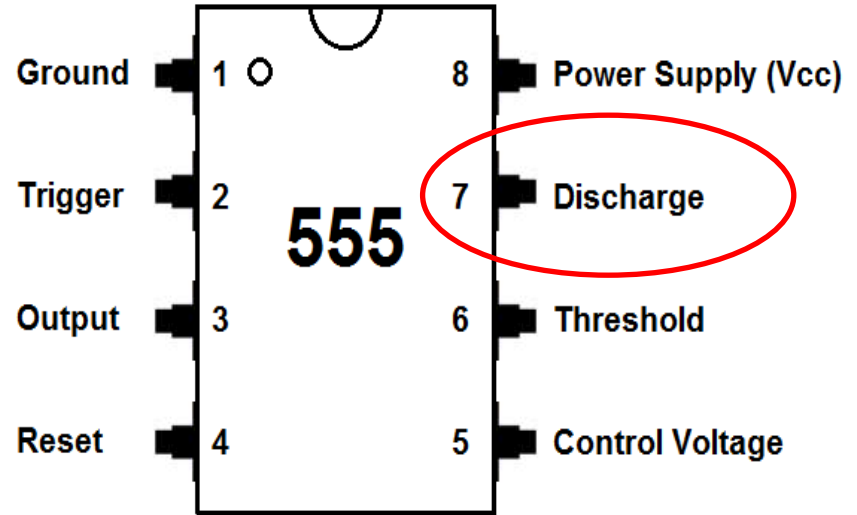


The 555 Timer



## Theory

Pin 7 is used to discharge an external capacitor that works in conjunction with a resistor to control the timing interval.

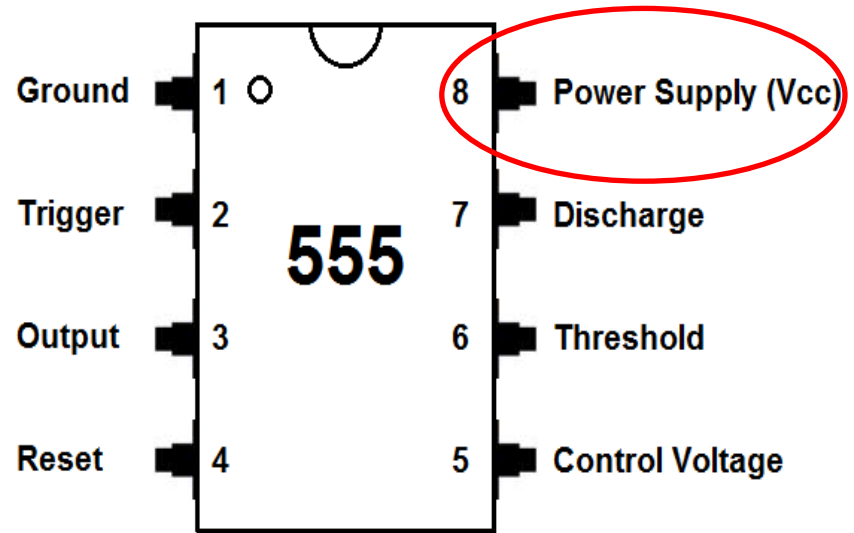


The 555 Timer



## Theory

- 555 timer ICs need DC voltage in order to operate. This is the pin which connects to the DC voltage to power the 555 chip.
- The voltage must be at least 4.5V and no greater than 15V.
- 555 timer circuits common using 4 AA or AAA batteries for 6V or a single 9V battery.



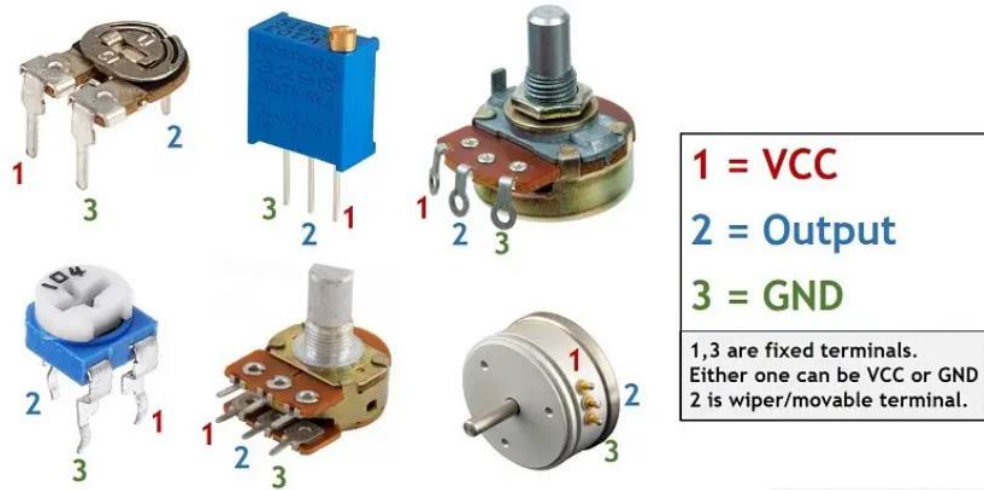
The 555 Timer





## Theory

- Potentiometer is a three-leg device with a sliding or rotating contact used to create variable resistance or voltage.
- the pinout of the potentiometer varies according to the type of potentiometer like sliding, rotating, or trim.

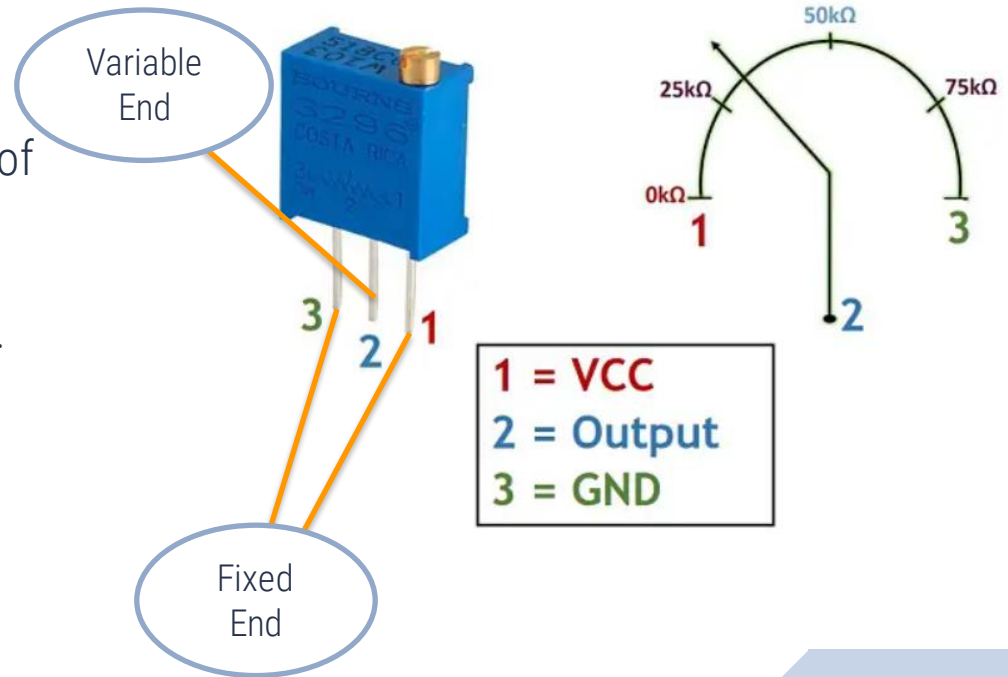


Potentiometer Pinout Diagram



## Theory

- Fixed End: connected to one end of the resistive track.
- Variable End: connected to the wiper, to provide variable voltage.
- Applications: voltage and current control circuits, used as volume control knobs in radios, tuning or controlling circuits, analog input control knobs.





## Theory

- A capacitor is a device that stores electrical energy in an electric field by virtue of accumulating electric charges on two close surfaces insulated from each other.
- We use 1nF capacitor, SMD, Ceramic, 1nF, 10%, 50V, X7R 0805 with 10% error.





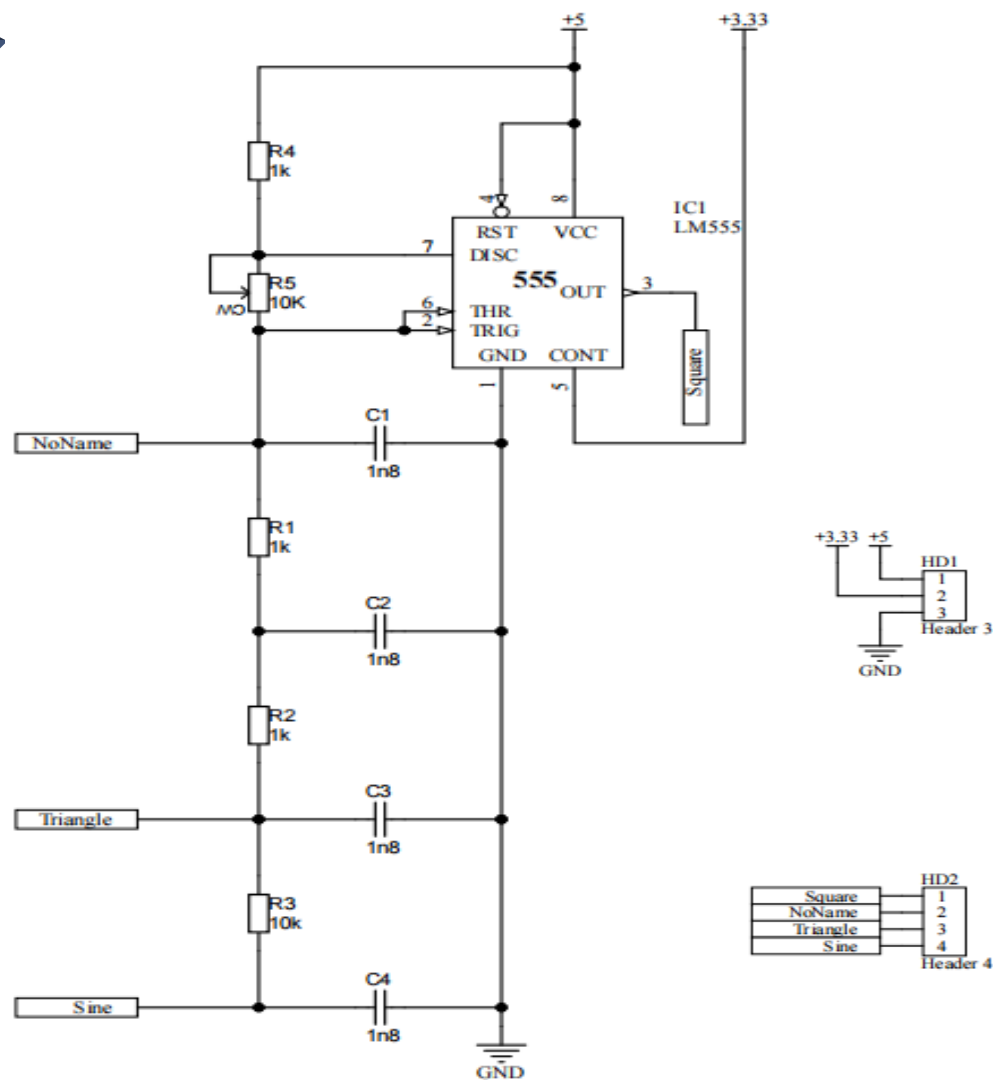
## Theory

- A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element.
- resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines.
- We use 1k $\Omega$  and 10k $\Omega$  resistor, SMD, 0.125W, 0805 with 5% error.





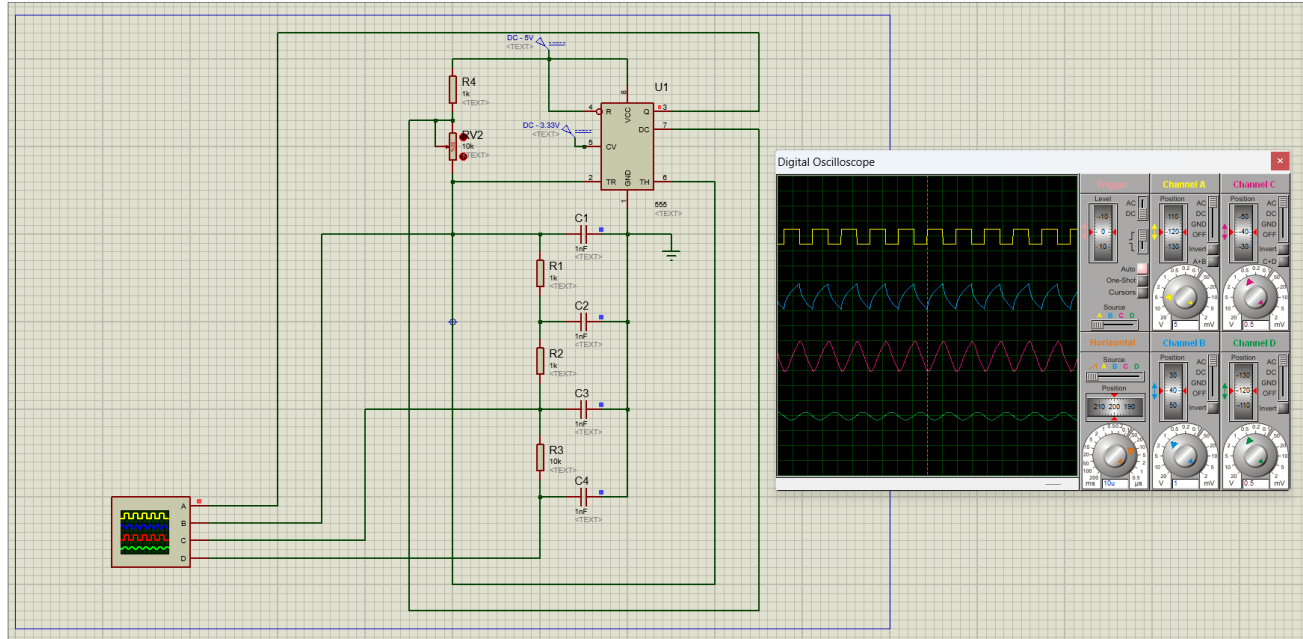
# Schematic



# 3

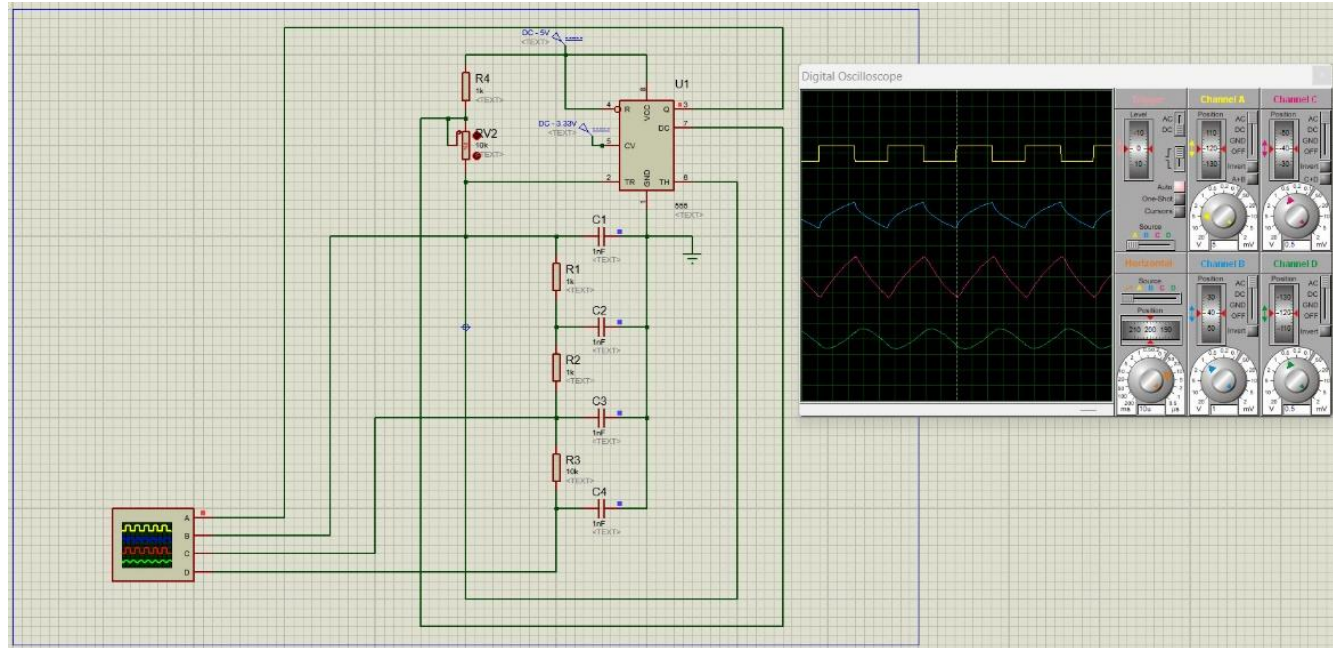
## **SIMULATION AND PERFORMANCE EVALUATION**





10kΩ potentiometer (50%)



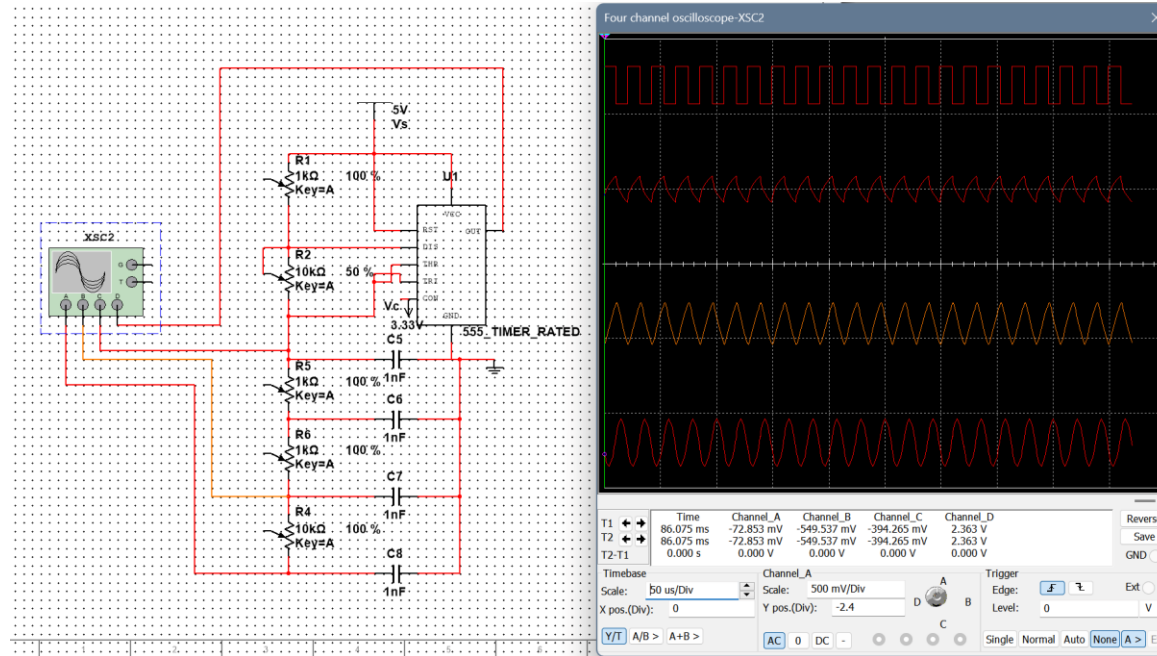


10kΩ potentiometer (0%)

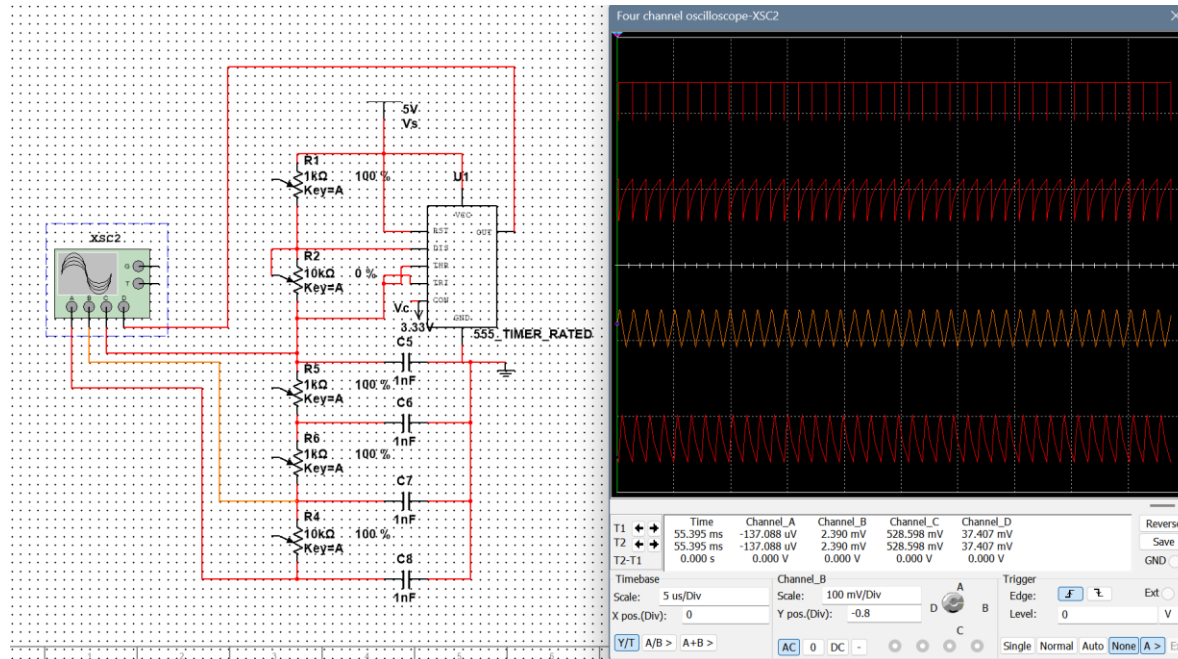




# NI Multisim



10kΩ potentiometer (50%)



10kΩ potentiometer (0%)



## Performance Evaluation

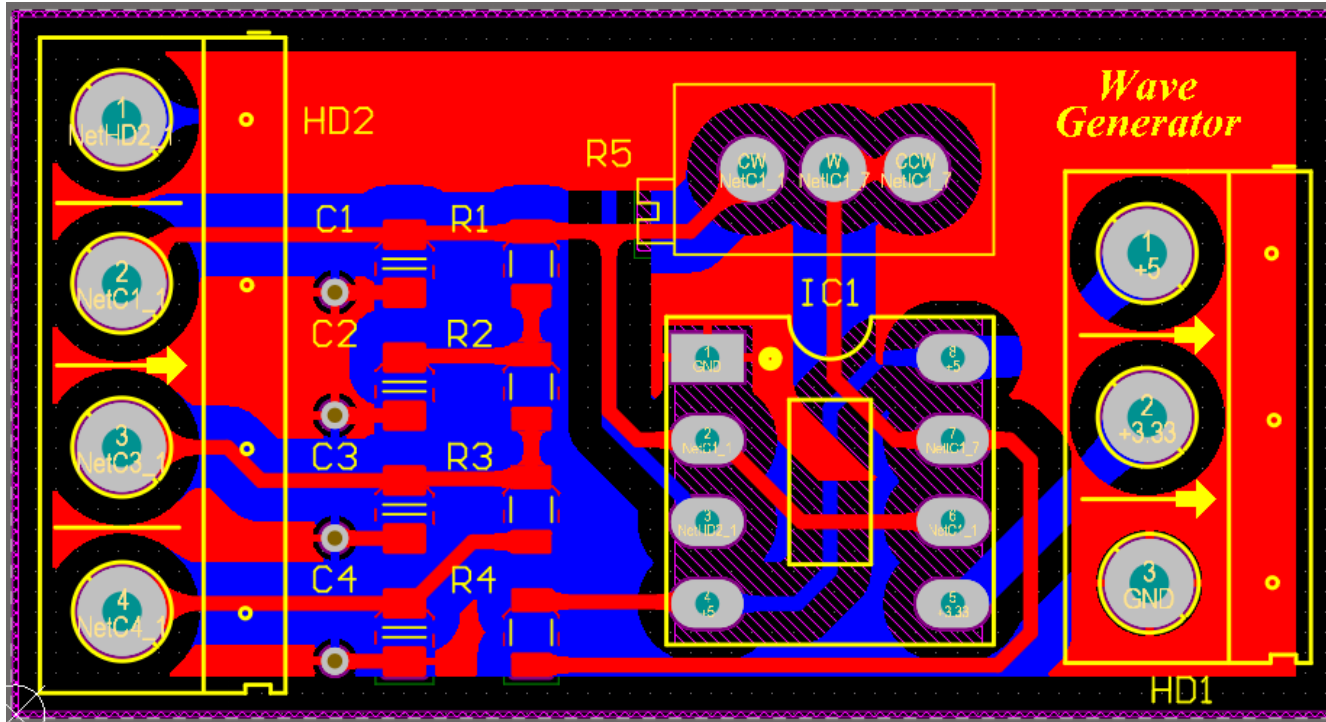
- The OUT pin of 555 Timer Chip generates square wave.
- The wave called “no name” wave with shape nearly like sine wave, is generated by combination of THR and TRIG pin of 555 Timer Chip.
- This signal of this wave convert to triangle wave after passing two 1kOhm resistors and filtering by two 1nF capacitors.
- ➔ It convert to sine wave after passing 10kOhm resistor and filtering continuously by 1nF capacitor, however the amplitude at this point reduce 10 times due to 10kOhm register.

# 4

## PCB FABRICATION

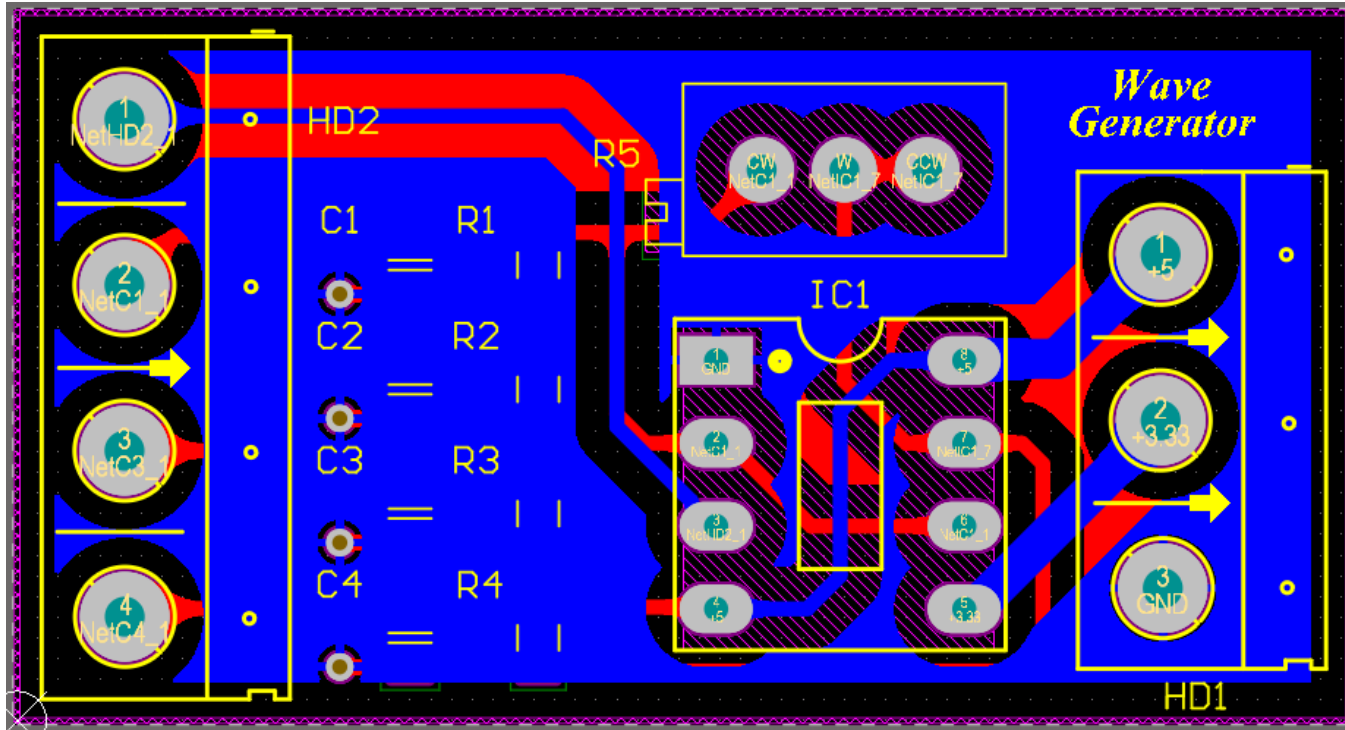


## Top Layer - 2D view





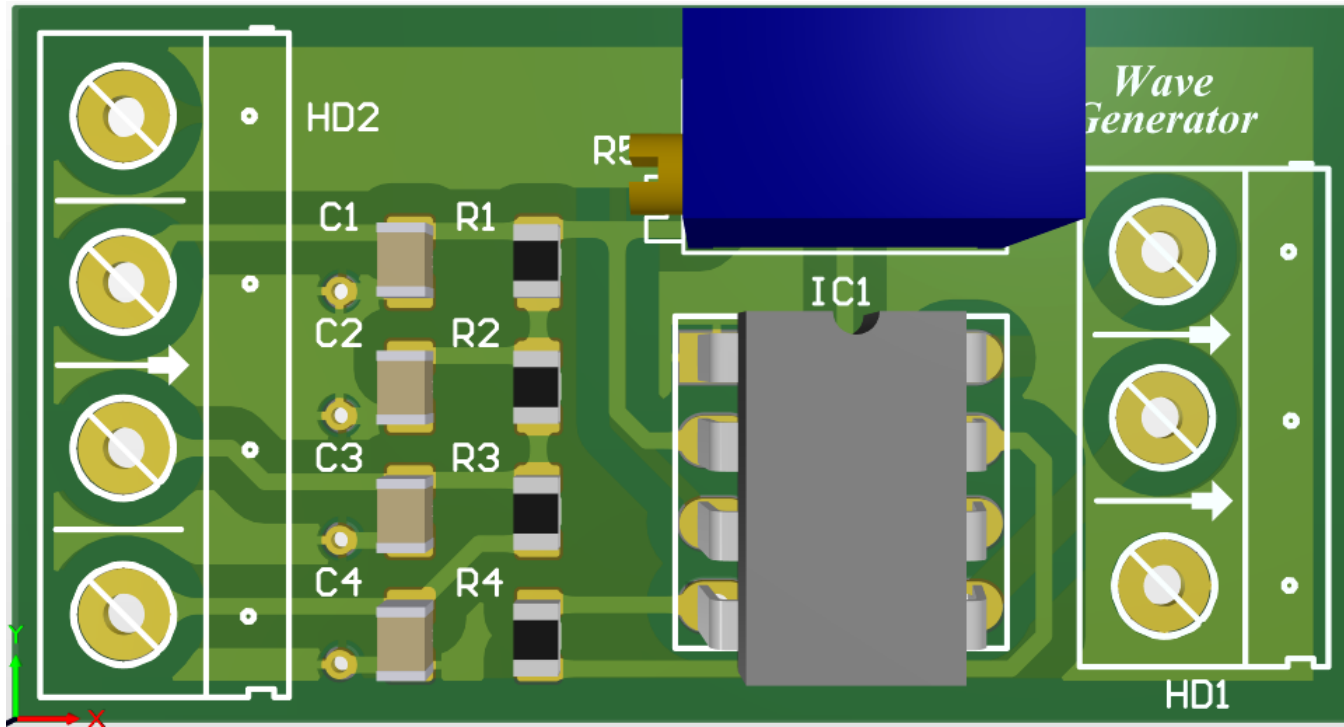
## Bottom Layer - 2D view





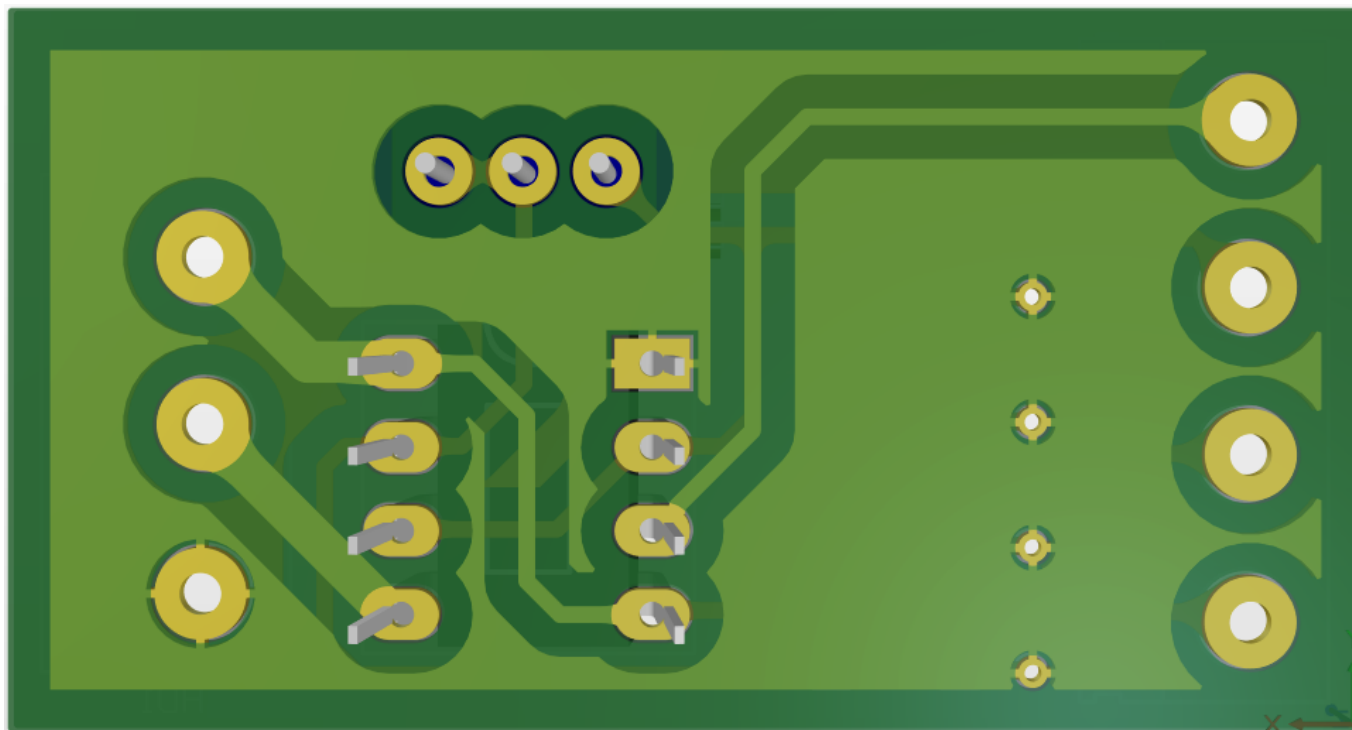


## Front - 3D view



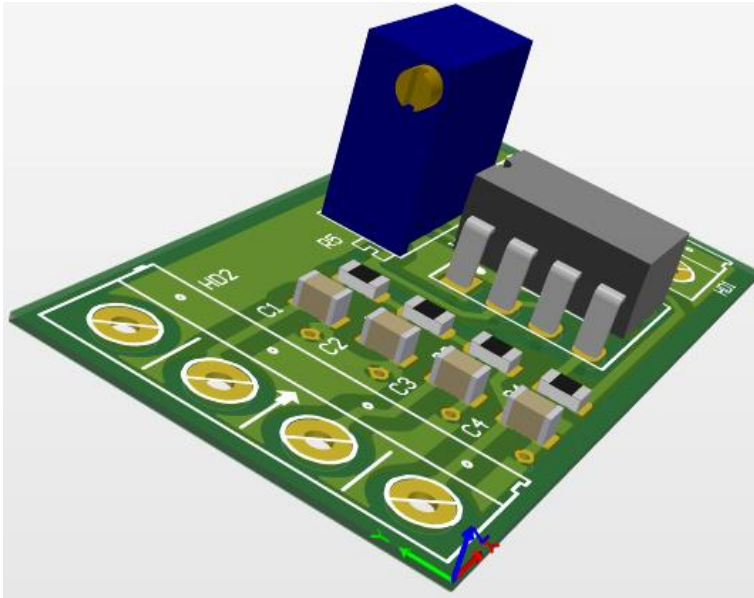


## Behind - 3D view

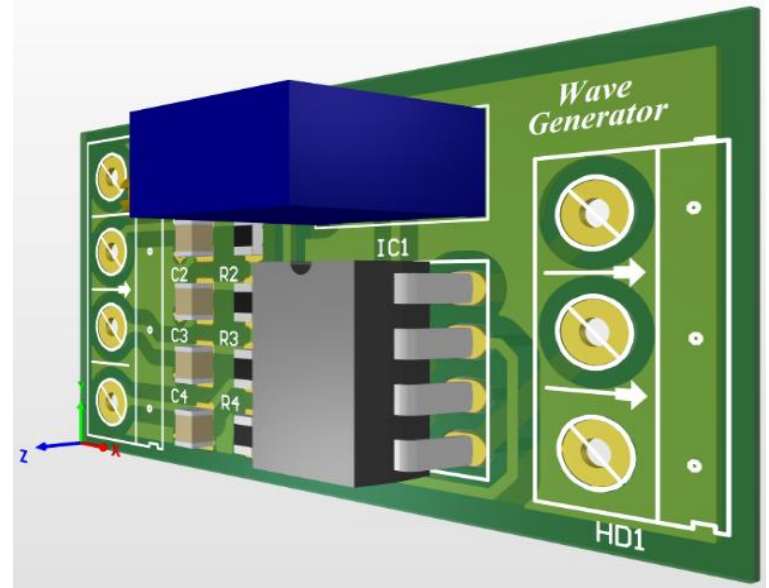




## Other angles - 3D view



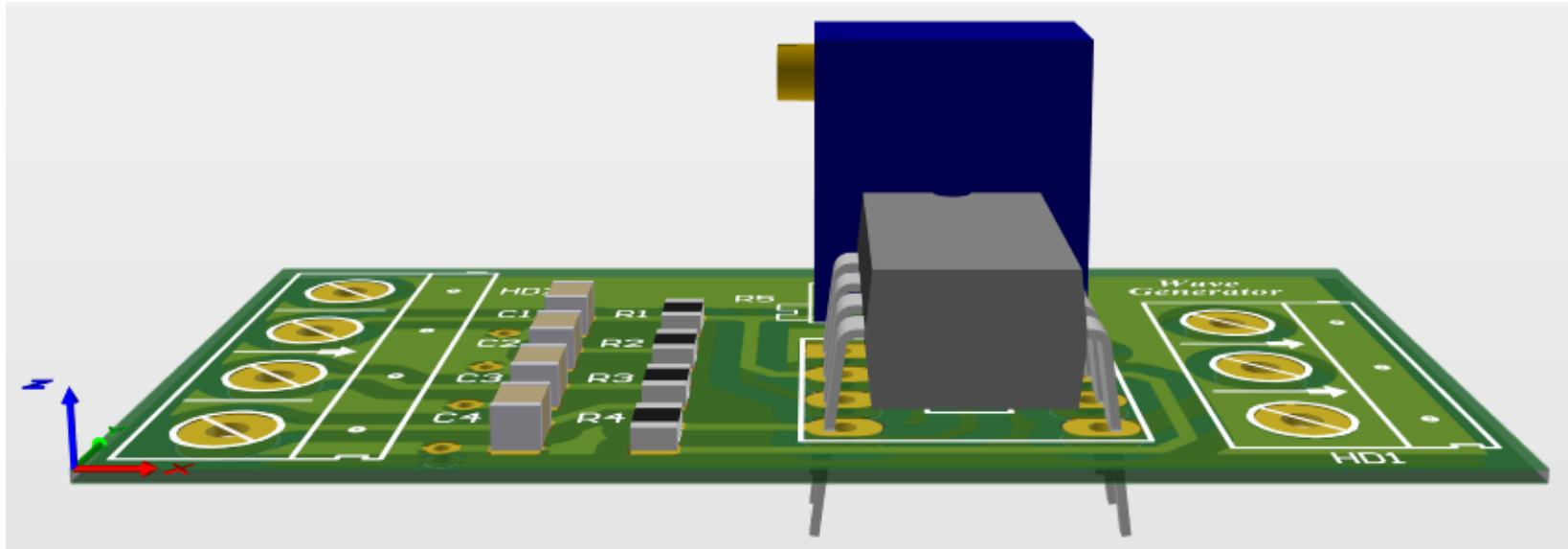
Top – down direction



Left – right direction



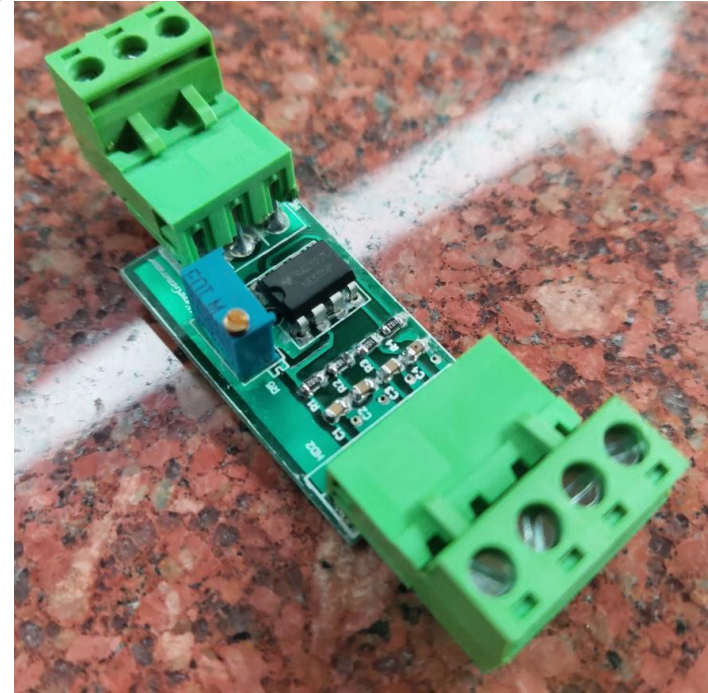
## Other angles - 3D view



Front – back direction



# Performance



# 5

## REFERENCES



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**THANKS!**