Piano Using IC555 on Single Sided PCB

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- Introduction:

IC555 is widely used in various circuits as timer. Here, we use IC555 to generate different frequencies (sounds) that is, we create a simple Piano using IC555. To achieve this, along with IC555, we use switches, resistors and capacitors. Finally, we design and implement the circuit on single sided PCB using ExpressSCH and ExpressPCB.

- Circuit Diagram:

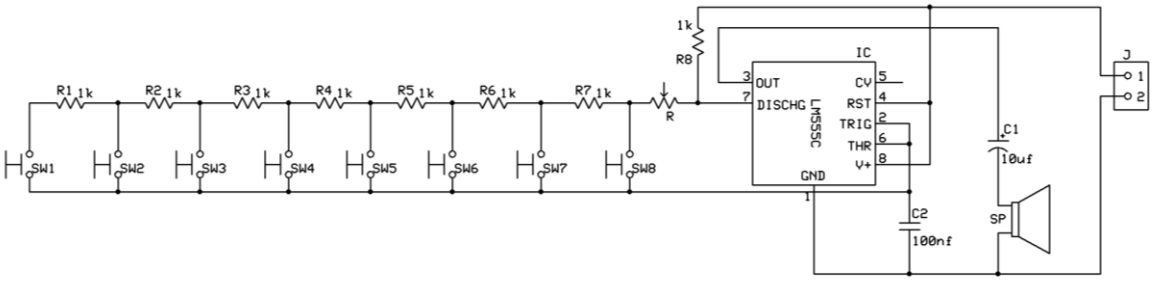


Fig. IC555 based Piano

- Components:

  - IC555 –

    IC555 is commonly called as 555Timer as it consist of three 5K internal resistors. Internally, it contains a flip-flop and two comparators. It has 8 pins details of which are as follows-

    1. Pin 1 (Ground) – This pin serves as Ground.
    2. Pin 2 (Trigger) – This pin serves as inverting input to one of the internal comparators which sets the flip-flop when voltage drops below 1/3 of Vcc.
    3. Pin 3 (Output) – This pin serves as Output.
    4. Pin 4 (Reset) – This pin is used to reset IC555.

5. Pin 5 (Controlled Voltage) – This pin serves as inverting input to one of the internal comparators. It controls the timing of 555 by overriding 2/3 of Vcc.
6. Pin 6 (Threshold) – This pin serves as non-inverting input to one of the internal comparators.
7. Pin 7 (Discharge) – This pin is connected to internal NPN transistor to discharge the capacitor.
8. Pin 8 (+Vcc) – This pin serves as supply between 4.5 V to 15 V.

- Resistors –

  7 Resistors of 1KΩ and 1 variable resistor of 10KΩ.

- Capacitors –

  One 10uF electrolytic and one 100nF ceramic capacitor.

- Switches –

  8 Push button switches.

- Working:

I. Working of IC555 –

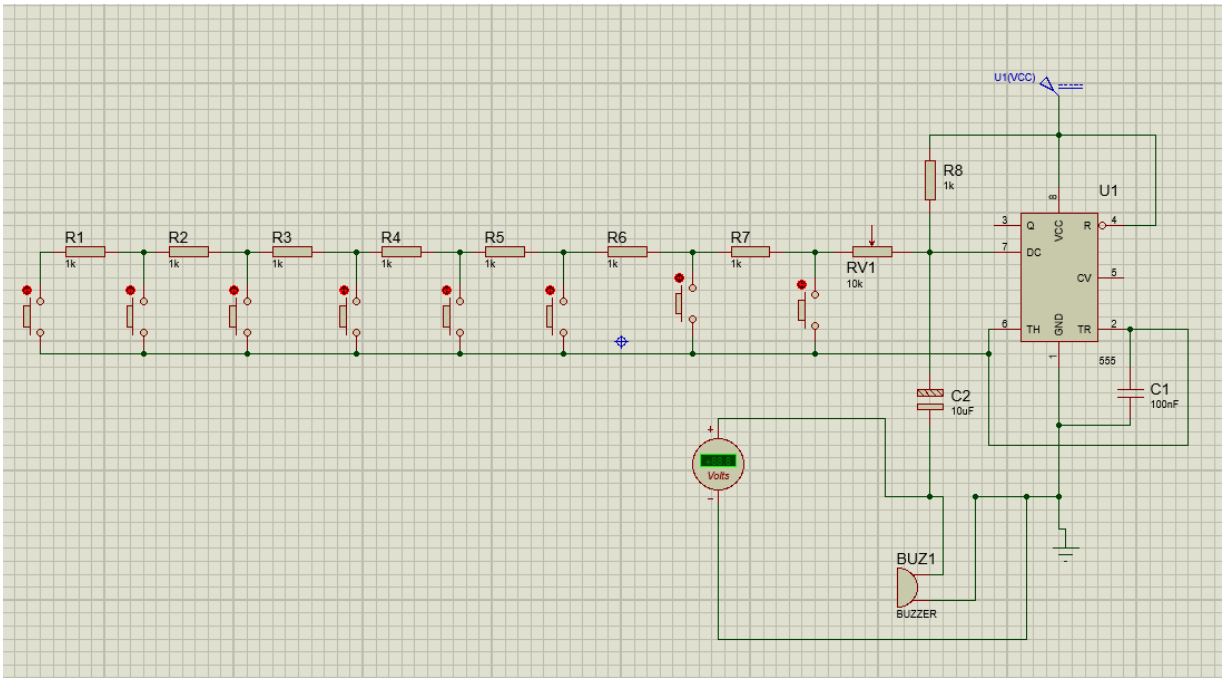
1. Three internal resistors of 5K acts as voltage regulator.
2. It consist of two comparator known as upper comparator and lower comparator
3. If voltage on non-inverting terminal is greater than inverting terminal then it generate logic 1 as output. Otherwise it generate logic 0 as output.
4. Threshold input is compared with 2/3Vcc in upper comparator and trigger is compared with 1/3Vcc in lower comparator.
5. Output of those comparators are fed to flip-flop. Complemented output of flip-flop is given to power amplifier which acts as not gate.

6. NPN transistor provides discharging path to externally connected capacitor and reset pin drives PNP transistor to reset device.

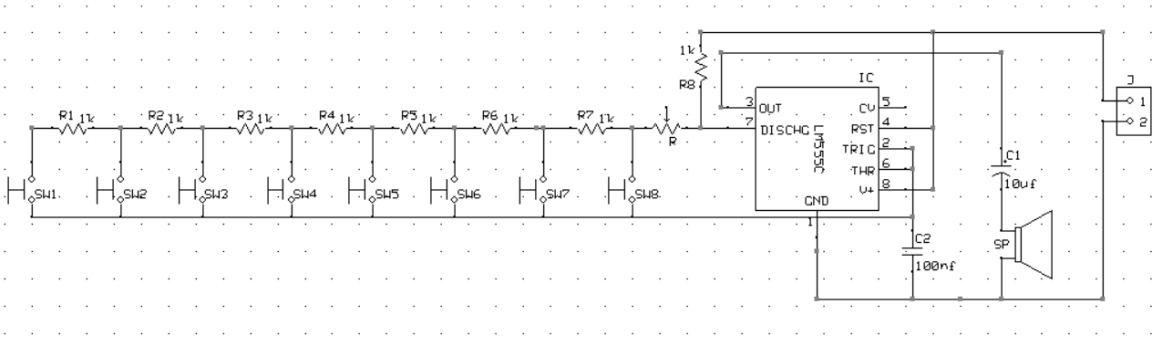
II. Working of Piano –

1. 9V supply is given to pin 4 and 8 of IC555
2. Pin 6 and 2 are shorted. Between pin 7 and pin 6, combination of resistors and switches are connected to vary the frequency of sound.
3. Voltage across capacitor which is connected between pin 2 and pin1 is acts as a trigger.
4. Another capacitor along with speaker is connected at pin 3 which provides necessary output.
5. Speaker is used to produce sound after pressing different keys on piano.

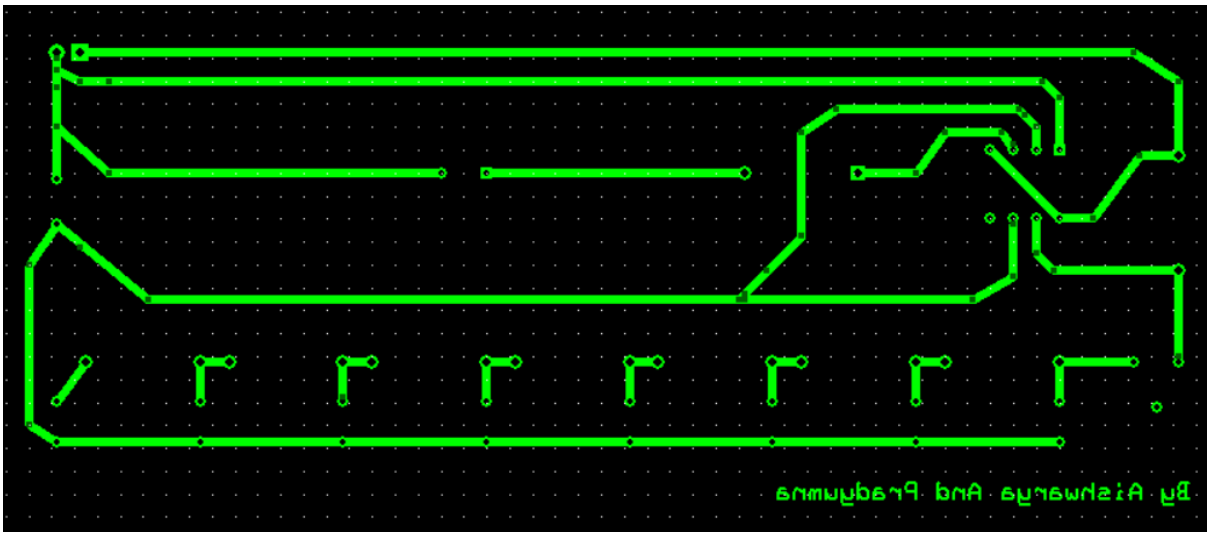
- Simulation:



- Schematic:



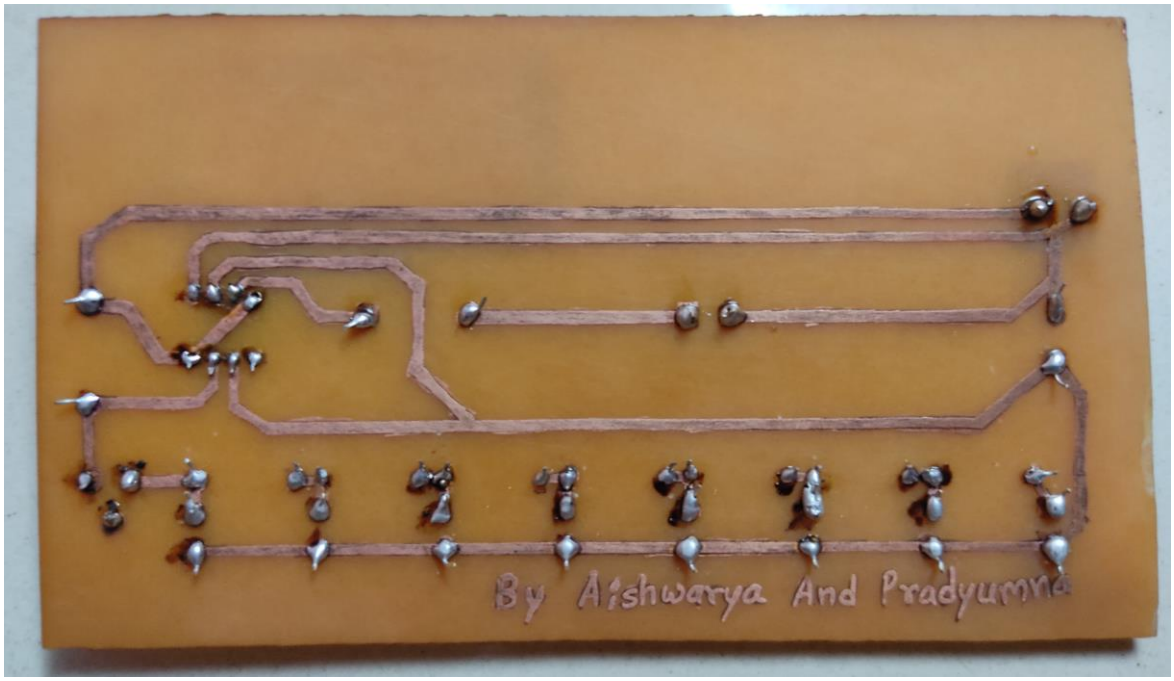
- PCB Layout:



- PCB Design Process:

1. Here we used ExpressSCH and ExpressPCB to create schematic and layout of the circuit respectively.
2. We printed the layout of circuit on glossy paper.
3. We created mirror image by heat-pressing printed layout on single sided PCB.
4. We removed copper from unwanted copper by etching using FeCl3 solution.
5. We drilled padding using hand driller and soldered the components after mounting them on appropriate places.
6. Finally, we tested the circuit.

- Final Circuit:



- Conclusion:

We studied IC555 along with PCB designing and implemented piano using IC555 on single sided PCB.