DSM LAB REPORT – 6

Part A: Decade Counter

Objective:

To build a circuit for a decade counter understand its usage.

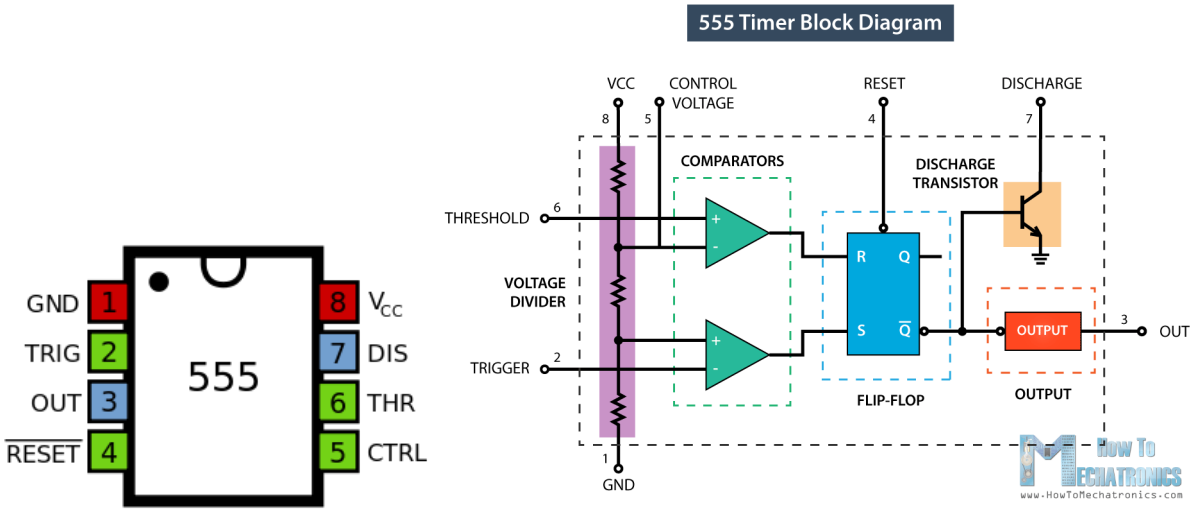
Components used:

- 555 Timer
- 7 segment Decoder (CD4511)
- 7 segment Display
- 4-bit ripple counter (74HC93)
- Logic AND gate
- Bread Board
- Arduino
- Resistors (7), capacitors (2)
- Led's (5) and connecting wires.

Description:

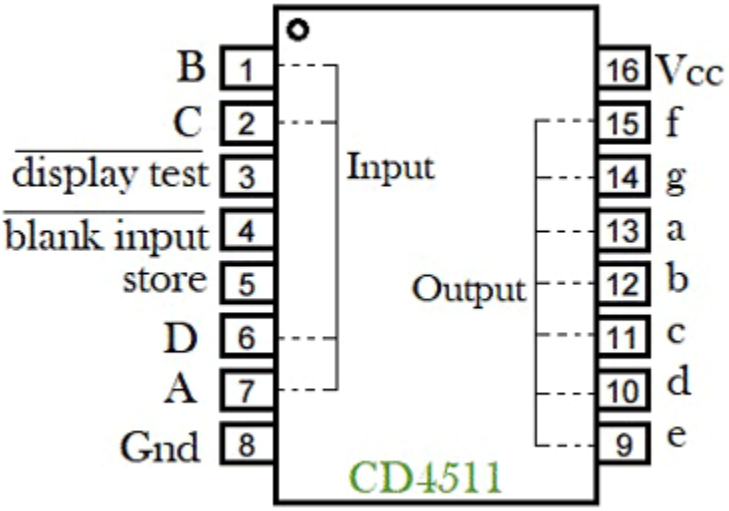
- 555 Timer:

555 timer IC is an integrated circuit (chip) used in a variety of timer, delay, pulse generation, and oscillator applications. This IC is useful for generating accurate time delays and oscillations. It is mainly useful for generating non-sinusoidal waveforms like square, ramp, pulse etc.



- 7 segment Decoder (CD4511):

IC CD4511 is a BCD to 7-segment latch decoder driver IC. This IC is used where we need to driving common-cathode displays like 7-segment display, low voltage fluorescent display, and incandescent display. It has high output-current-sourcing up to 25mA comes with a lamp test and blanking capability to test the display. It is having a DC supply input that ranges from 3 to 18V.

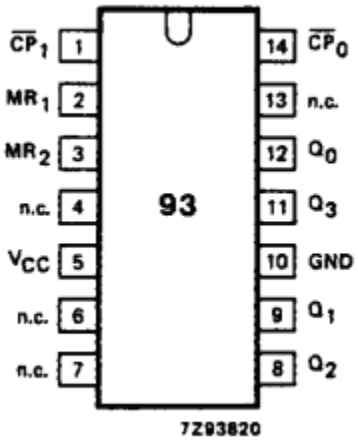


Pinout of CD4511 IC

- **4**-Bit ripple counter

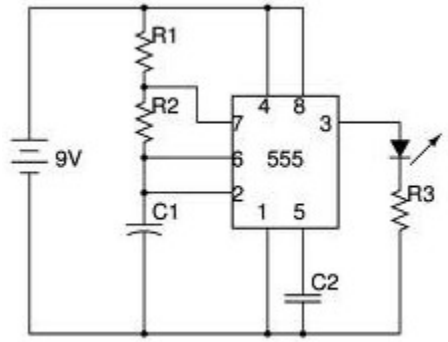
74HC93 are 4-bit binary ripple counters. In a 4-bit ripple counter, the output Q0 must be connected externally to input CP1. The input count pulses are applied to

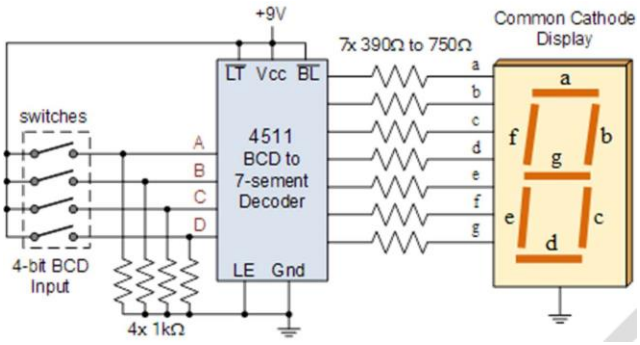
clock input CP0. Simultaneous frequency divisions of 2, 4, 8 and 16 are performed at the Q0, Q1, Q2 and Q3 outputs. As a 3-bit ripple counter, the input count pulses are applied to input CP1. Simultaneous frequency divisions of 2, 4 and 8 are available at the Q1, Q2 and Q3 outputs.



Pinout of 74HC93

Reference Circuit:





Procedure:

- Drag the Breadboard and an Arduino on to the workspace.
- Connect the 5V pin of the Arduino to the + lower most strip on the bread board. Using a wire connect one of these points to the uppermost positive strip of the breadboard so as to make the potentials of all the horizontal points on that strip 5V.
- Similarly connect the GND pin of the Arduino the negative bottom most strip of the breadboard. All the points on this horizontal strip will have 0V potential.
- Create the timer using connections showed in reference circuit.
- Create a 4-bit counter by using the 74HC93 IC as shown in the reference circuit.
- We need to count upto 9 only so we input the AND of D and B to the reset buttons implies that it will show upto 9 only
- Then connect it to the 7-segmentation decoder 7 segment displays for displaying the numbers.
- We are not using any code here.

Observations:

Truth table for Decade counter:

Input Pulses	Q3	Q2	Q1	Q0
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

We will AND the outputs Q3 and Q1 so it will stop at 9 and repeats from the beginning.

Link for Tinker cad simulation:

https://www.tinkercad.com/things/0kuF3LFw1TV-2020102062lab6part1/editel?sharecode=cYhBfnBVFsvf4oAavOhjoGFNI3vSi6yhWaNIsOUMh4s

Conclusion:

In this experiment, I understood the usage of decade counter. In this experiment, I made a sequential circuit that counts from 0 to 9 and then resets back to 0 and so on.

Part-2 Shift Register (A and B)

Objective:

To build a circuit for shift register and understand its usage

Electronic components used:

1) IC 74HC595(SHIFT REGISTER)

2) LED'S in ORDER of 8 bit

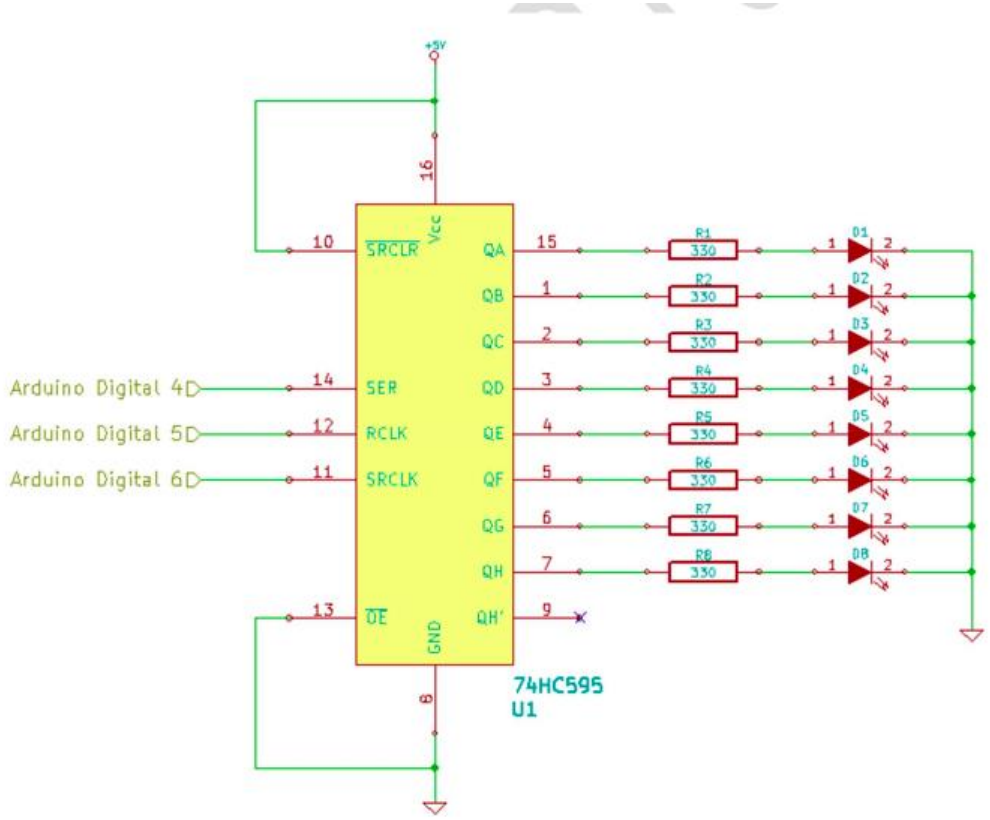
3) Resistors

4) Connecting Wires

5) Bread Board

6) Arduino uno R3

Reference circuit:



Procedure:

- Drag a breadboard and an Arduino on to the workspace and connect the bottom most + and – strips of the breadboard to the 5V pin and the GND pin of the Arduino respectively.
- Now we need to place the IC 74HC595 on bread board
- Connect the IC with the sufficient inputs as shown in the reference circuit
- The below code can be used to manually give the inputs to the Clk by uncommenting the commented parts and some more little changes.

CODE Part A

```
// ST_CP pin 12
const int latchPin = 10;
// SH_CP pin 11
const int clockPin = 11;
// DS pin 14
```

```
const int dataPin = 12;
void setup ()
{
	// Setup pins as Outputs
	pinMode(latchPin, OUTPUT);
	pinMode(clockPin, OUTPUT);
	pinMode(dataPin, OUTPUT);
}
void loop()
{
	// Count from 0 to 255 and display in binary
	for (int numberToDisplay = 0; numberToDisplay < 256; numberToDisplay++)
	{
		// ST_CP LOW to keep LEDs from changing while reading serial data
		digitalWrite(latchPin, LOW);
		// Shift out the bits
		shiftOut(dataPin, clockPin, MSBFIRST, numberToDisplay);
		// ST_CP HIGH change LEDs
		digitalWrite(latchPin, HIGH);
		delay(500);
	}
}
```

Code Part B:

```
// ST_CP pin 12
const int latchPin = 10;
// SH_CP pin 11
const int clockPin = 11;
// DS pin 14
const int dataPin = 12;
int x;
void setup ()
{
	// Setup pins as Outputs
```

```
Serial.begin(9600);
        pinMode(latchPin, OUTPUT);
pinMode(clockPin, OUTPUT);
pinMode(dataPin, OUTPUT);
}
void loop()
{
// Count from 0 to 255 and display in binary
if(Serial.available() == 1)
  {
        x = Serial.read();
x = x - '0';
int y =1;
        for(int e =0;e<x;e++)
        {
        y=y*2;
        }
// ST_CP LOW to keep LEDs from changing while reading serial data
        digitalWrite(latchPin, LOW);

// Shift out the bits
        shiftOut(dataPin, clockPin, MSBFIRST,y);
        digitalWrite(latchPin, HIGH);
        Serial.print("Input of Q: ");
        Serial.println(x);
        Serial.print("output of Q: ");
        Serial.println(y);
  }
}
```

Observations:

2A.

1) In 2A part we observed that by using shiftout function of 4 node by giving a number to convert it to shift registers output it depends on MSB andLSB.

2) Now by we used a for loop in part A we will see that it shows all binary digits from 0-255 in order with each 300ms delays.

2B.

1) In the part B we see that we given an input from 0-7 it will show the corresponding Qi that is 0<=i<=7 as out puts of led ON

2) It shows let's say for if we give 5 it will show Q5 as LED ON and all others LED will remain OFF.

Truth Table:

Inputs	Q7	Q6	Q5	Q4	Q3	Q2	Q1	Q0
0	0	0	0	0	0	0	0	1
1	0	0	0	0	0	0	1	0
2	0	0	0	0	0	1	0	0
3	0	0	0	0	1	0	0	0
4	0	0	0	1	0	0	0	0
5	0	0	1	0	0	0	0	0
6	0	1	0	0	0	0	0	0
7	1	0	0	0	0	0	0	0

Link for PartA:

https://www.tinkercad.com/things/7d78F7gcz8Y-2020102062lab6part2a/editel?sharecode=QABdjSA1eNgc5U-oQB0QeEUYW-4hagHGm1engZMm9T4

Link for Part B:

https://www.tinkercad.com/things/aS3y8d40C3V-2020102062lab6part2b/editel?sharecode=GKP1z69VMSNyDRk6aXFQSu4FGWg2CzlgPQZ5Ol0IOLY

Conclusion:

I understood the usage of shift registers and their functionality and the functions like shiftOut() and etc.

-- >> Macharla Harish

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