Lab-12

555 One-Shot
Latch and Flip-Flop

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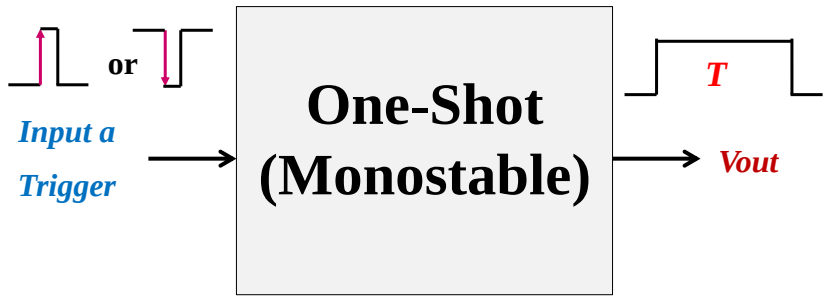
Objectives

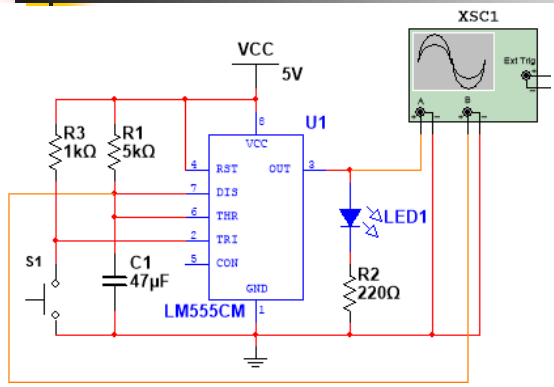
- Understand the fundamental of a one shot based on timer 555.
- Understand the fundamental of an R-S latch.
- Understand the fundamental of D Flip-Flop, such as TTL 7474.
- Understand the fundamental of J-K Flip-Flop, such as TTL 7476.
- Understand the fundamental of T Flip-Flop, which is the function divided by 2.
- Can implement various combinations of Latches and Flip-Flops.

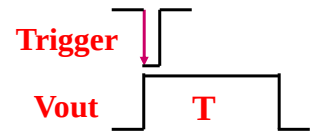
What is One-Shot

- ***Vout*** **output a voltage for a time** ***T*****, if a signal is triggered once to the input.**

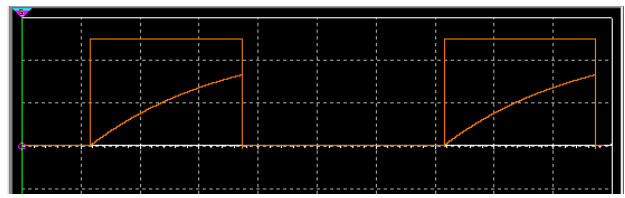


One-Shot based on 555



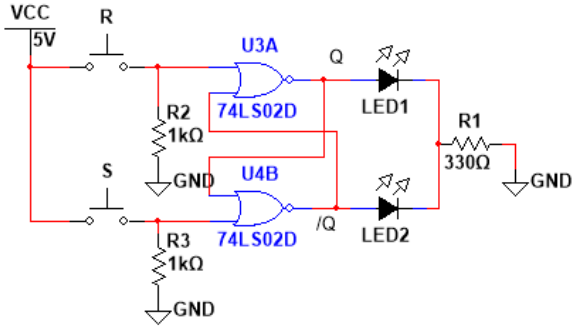


Vout: 0V-5V-0V Pulse
Vc1: 0V→ 2/3*5V→0V
exponential wave
T = 1.1*R1*C1
= 1.1*5k*47µ
= 258.5ms



R-S Latch

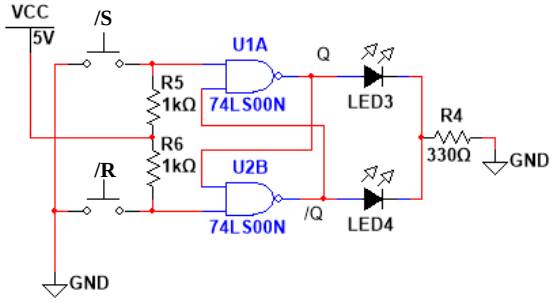
- **Reset** and **Set** are active at logic High (**1**).
- **Set** is to Q to be 1; **Reset** is to Q to be 0.
- **Reset** and **Set** cannot be **1** at the same time.



Input		Output	
R	S	Q	/Q
0	0	hold	hold
0	1	1	0
1	0	0	1
1	1	X	X

/R-/S Latch

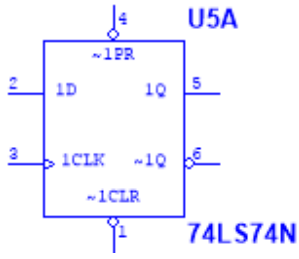
- **Reset** and **Set** are active at logic **Low** (**0**).
- **/Set** is to Q to be 1; **/Reset** is to Q to be 0.
- **/Reset** and **/Set** cannot be **0** at the same time.



Input		Output	
/R	/S	Q	/Q
0	0	X	X
0	1	0	1
1	0	1	0
1	1	hold	hold

D Flip-Flop

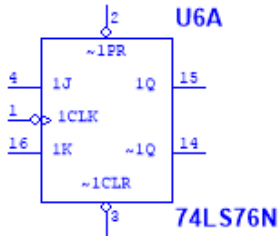
- **TTL 7474**： **Dual D Flip-Flop**



/PR	/CR	D	CK	Q
0	0	X	X	Unknow
0	1	X	X	1
1	0	X	X	0
1	1	X	X	Hold
1	1	0	0→1	0
1	1	1	0→1	1

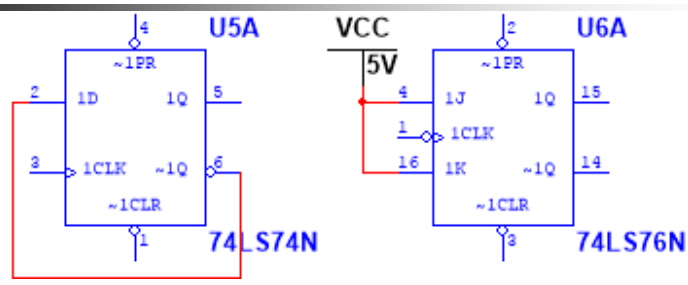
J-K Flip-Flop

- **TTL 7476**： **Dual J-K Flip-Flop**



/PR	/CR	J	K	CK	Q
0	0	X	X	X	Unknow
0	1	X	X	X	1
1	0	X	X	X	0
1	1	X	X	X	Hold
1	1	0	0	0→1→0	Hold
1	1	0	1	0→1→0	0
1	1	1	0	0→1→0	1
1	1	1	1	0→1→0	Toggle

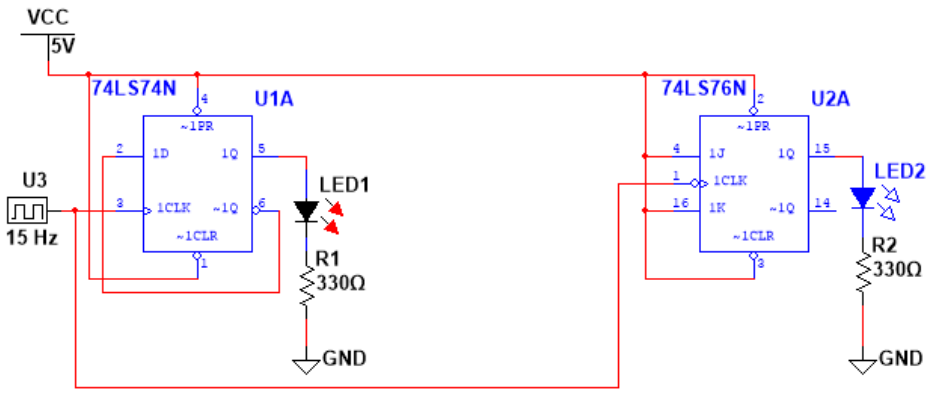
T Flip-Flop



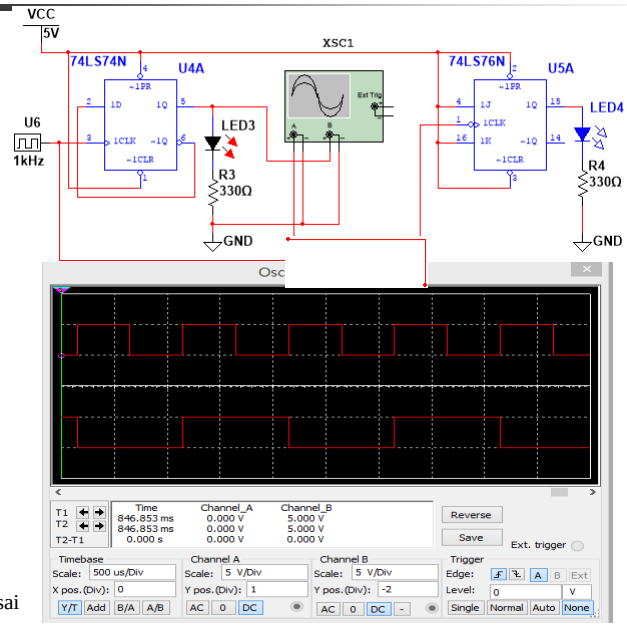
/PR	/CR	CK	Q
0	0	X	Unknow
0	1	X	1
1	0	X	0
1	1	X	Hold
1	1	0→1 or 0→1→0	Toggle

÷ 2 based on T Flip-Flop

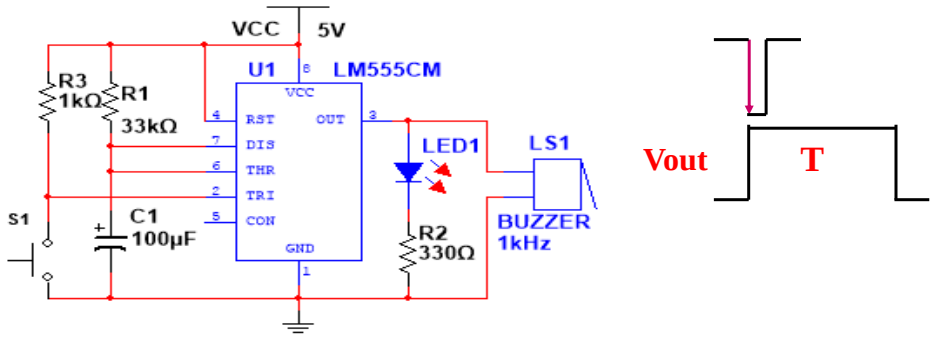
- Two kinds of T-FFs



÷ 2 based on T Flip-Flop

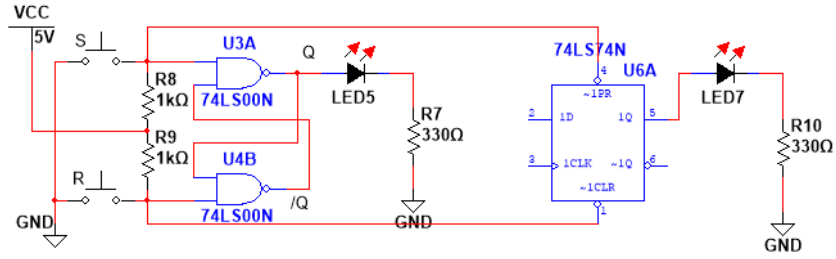


Experiment-1 One-Shot based on 555



Push S1 once, LED1 & Buzzer are on for a time,
T = 1.1*R1*C1 = 1.1*33k*100µ = 3.53 s

Experiment-2 /R-/S Latch



Input		Output
/R	/S	Q
1	1	Hold
1	0	1
0	1	0
0	0	X

Push S once, Q is **1**
Push R once, Q is **0**

Experiment-3 ÷16 based on JK FFs

Counting: 0000~1111 (÷ 16)
Push Preset once, LEDs = 1111
Push Clear once, LEDs = 0000