Lab-11

Astable Oscillator

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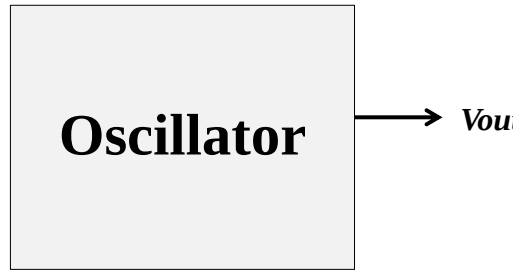
Objectives

- Understand the fundamental of an oscillator.
- Understand the fundamental of astable multivibrator.
- Understand the function of a timer 555.
- Understand various astable oscillators using timer 555.
- Can implement various astable oscillators using timer 555.

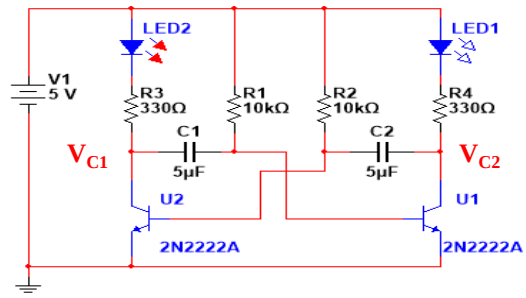
What is oscillator

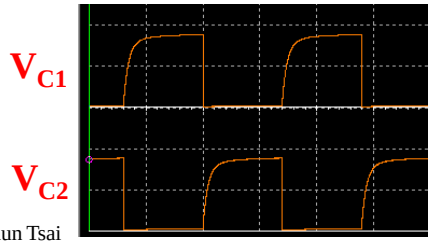
- ***Vout*** **can output a voltage waveform such as *sinusoidal*, *square*, or *triangle* waveform.**



Astable Multivibrator

- **It consists of two Transistors and R/C components.**

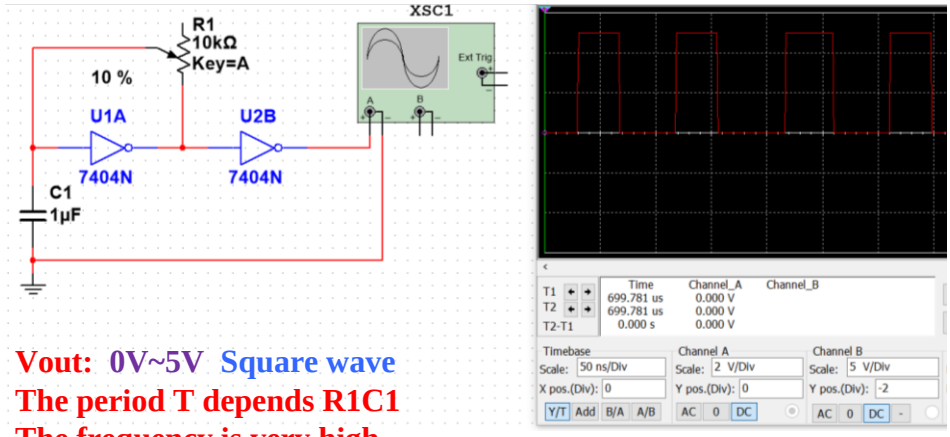




Vout: 0V~5V Square wave
T = 0.693(R1C1+R2C2)
T = 0.693*10k*5µ*2 = 69.3ms
F = 1/T = 1 / 69.3m
= 14.43 Hz

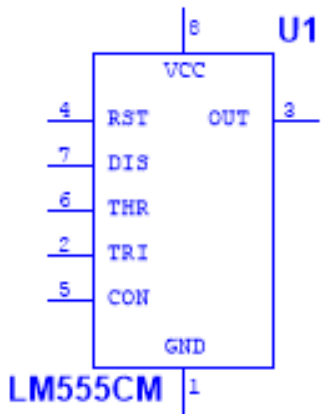
Astable Multivibrator

- It consists of two NOTs.



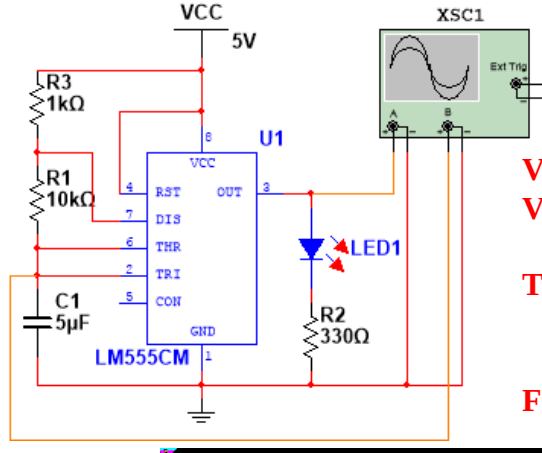
Vout: 0V~5V Square wave
The period T depends R1C1
The frequency is very high (tens of MHz)

Introduction to 555 Timer



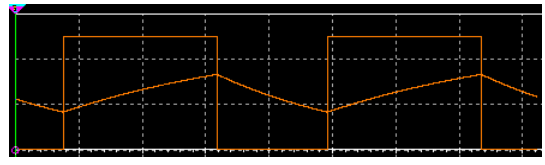
Vcc(8): 5V~15V
GND(1): 0V
OUT(3): 0V or VCC
RST(Reset)(4): if RST=0V,OUT=0V
RST=Vcc if normal state
THR(Threshold)(6): if THR≧2/3 Vcc, then OUT=0V
DIS(Discharge)(7)): for discharging
TRI(Trigger)(2): if TRI≦1/3 Vcc, then OUT=Vcc
Con(Control voltage)(5): Connect 0.1μF to GND in general

555 Astable OSC

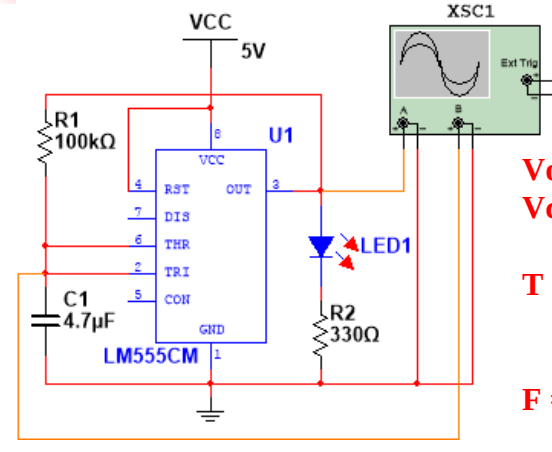


Vout: 0V~5V Square wave
Vc1: 1/3*5V ~ 2/3*5V
exponential wave
T= 0.693*(R3+2R1)*C1
= 0.693*(1k+2*10k)*5μ
= 72.8ms
F = 1/T= 1/72.8m = 13.7Hz

V_{OUT}
V_{C1}

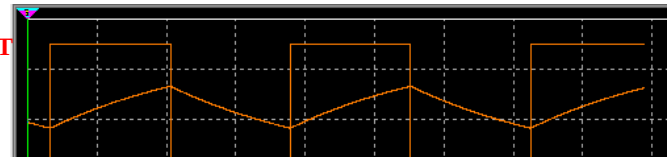


555 Reduced Astable OSC

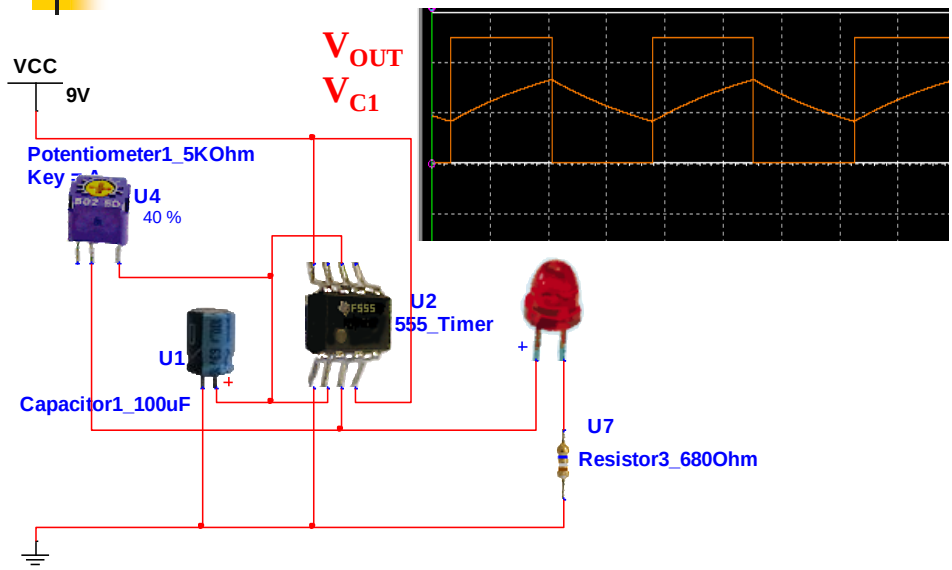


Vout: 0V~5V Square wave
Vc1: 1/3*5V ~ 2/3*5V
exponential wave
T = 0.693 * 2*R1*C1
= 0.693*2*100k*4.7μ
= 651.4ms
F = 1/T =1/651.4m≒1.5Hz

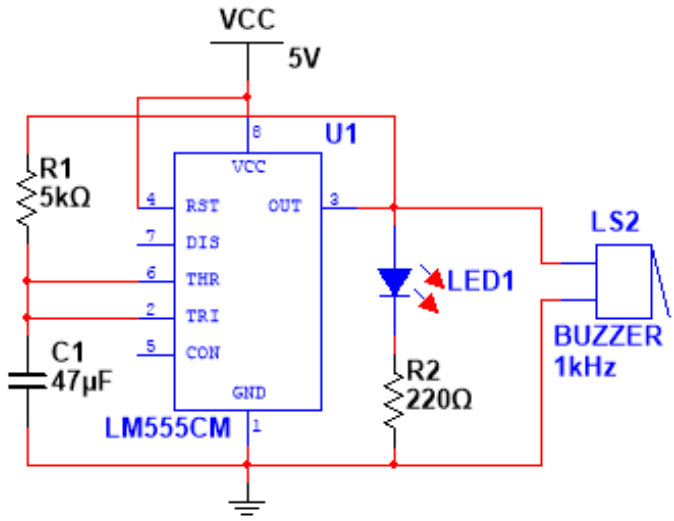
V_{OUT}
V_{C1}



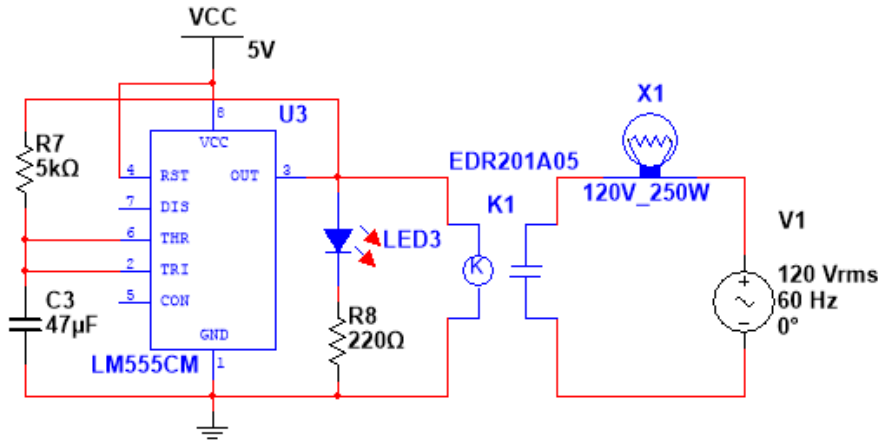
555 Astable



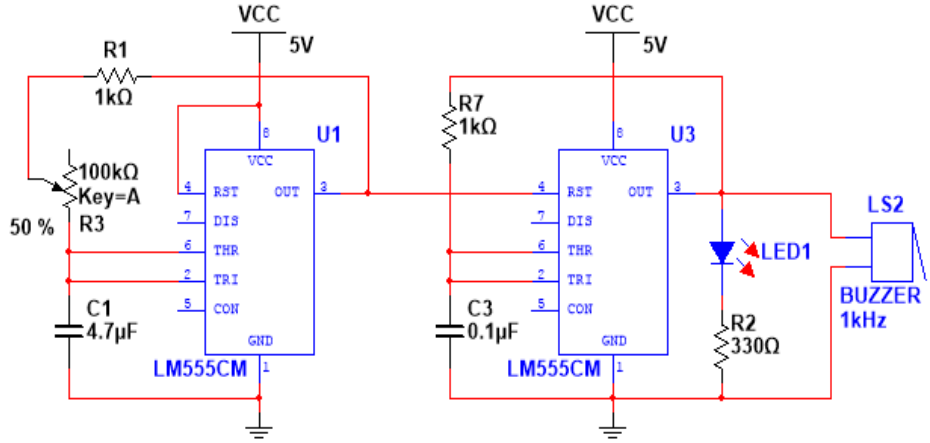
555 Astable Applications



555 Astable Applications



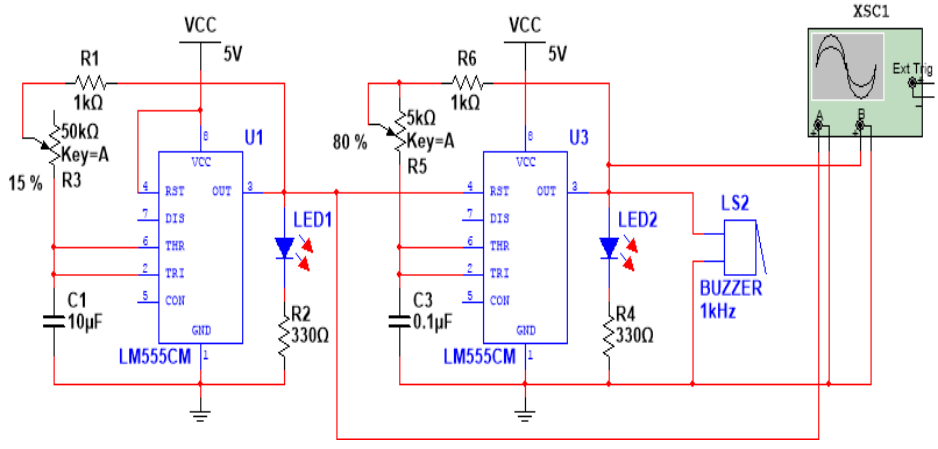
Dual Sound based on two 555 Astables



Low frequency + High frequency

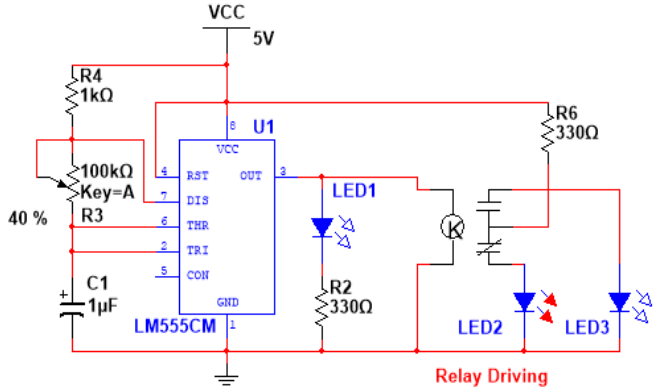
LED1 or buzzer will be dual-various by adjusting the potentiometer 100KΩ

Dual Sound based on two 555 Astables

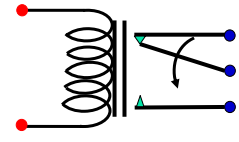


Low frequency + High frequency

Experiment-1 555 Astable OSC

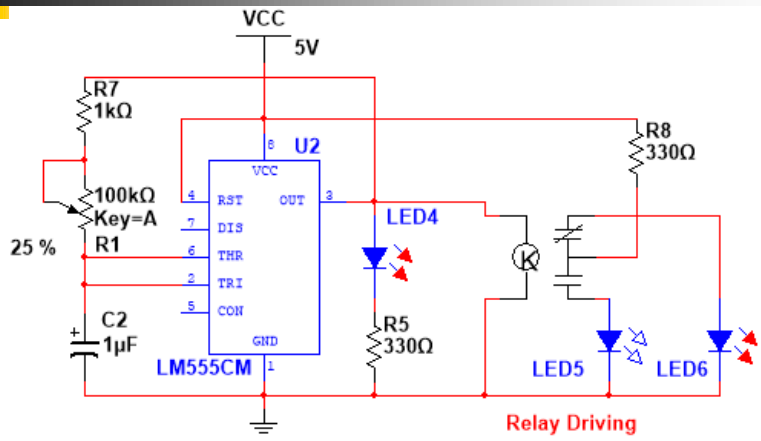


Relay (5 pins)



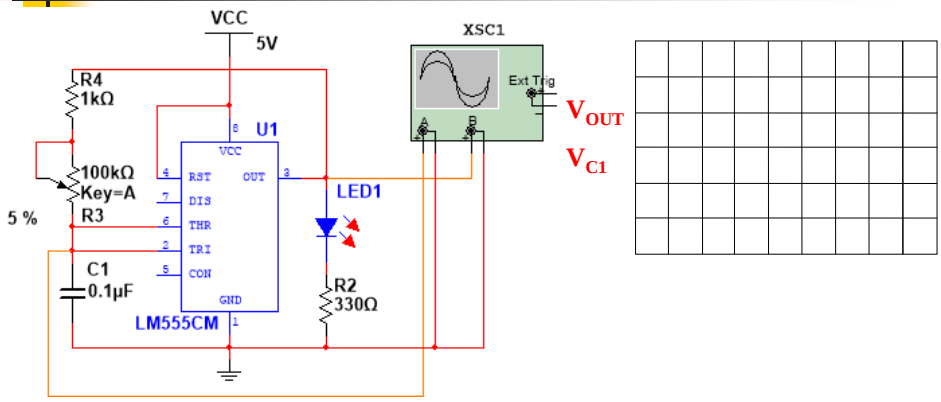
1. **How about working are for LEDs and Relay?**
2. **What will happen for LEDs if adjusting the potentiometer R3?**
3. **If LED1 can ON/OFF alternatively, please compute the frequency.**

Experiment-1a 555 Astable OSC



1. How about working are for LEDs and Relay?
2. What will happen for LEDs if adjusting the potentiometer R3?
3. If LED4 can ON/OFF alternatively, please compute the frequency.

Experiment-2 555 Astable OSC



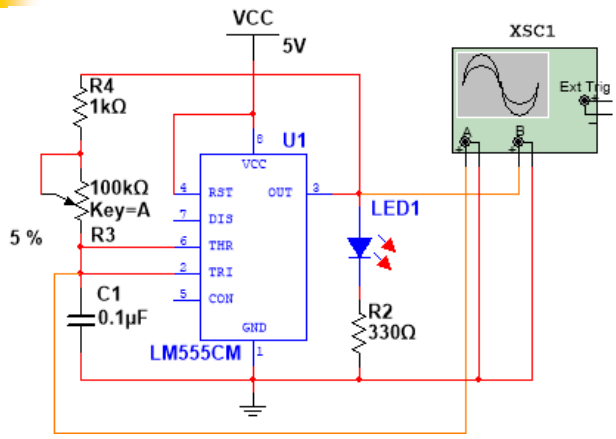
If LED1 can ON/OFF alternatively by adjusting the potentiometer R3, then measure

Vout: _____ wave , _____ V ~ _____ V

Vc1 : _____ wave , _____ V ~ _____ V

T = _____ s and F = 1/T = _____ Hz

Experiment-2a 555 Astable OSC



If we want a 1kHz clock signal (i.e., Vout is square waveform with 0~5V), how about are for the values of resistors (R3+R4) and capacitor C1。