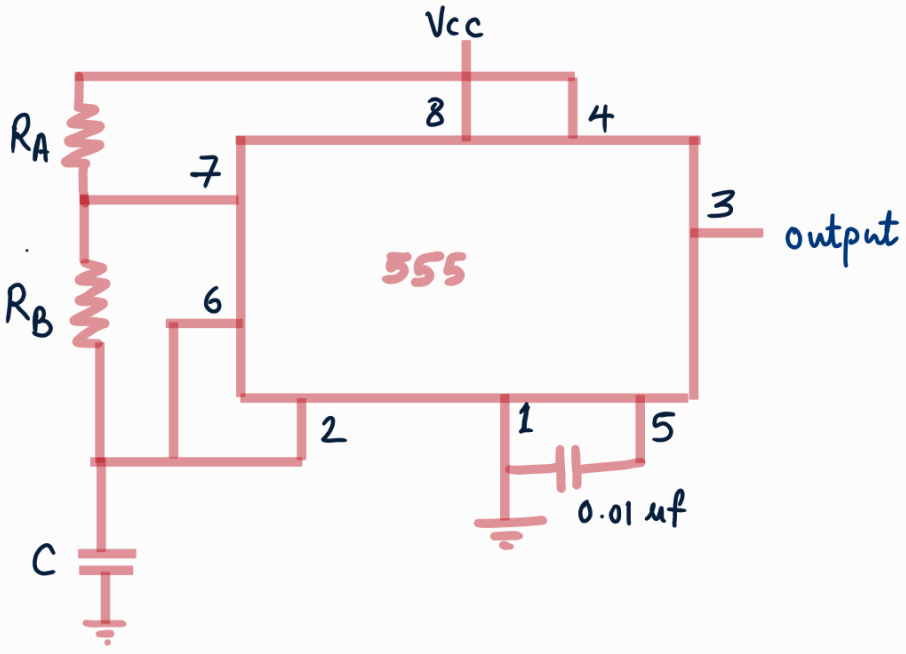
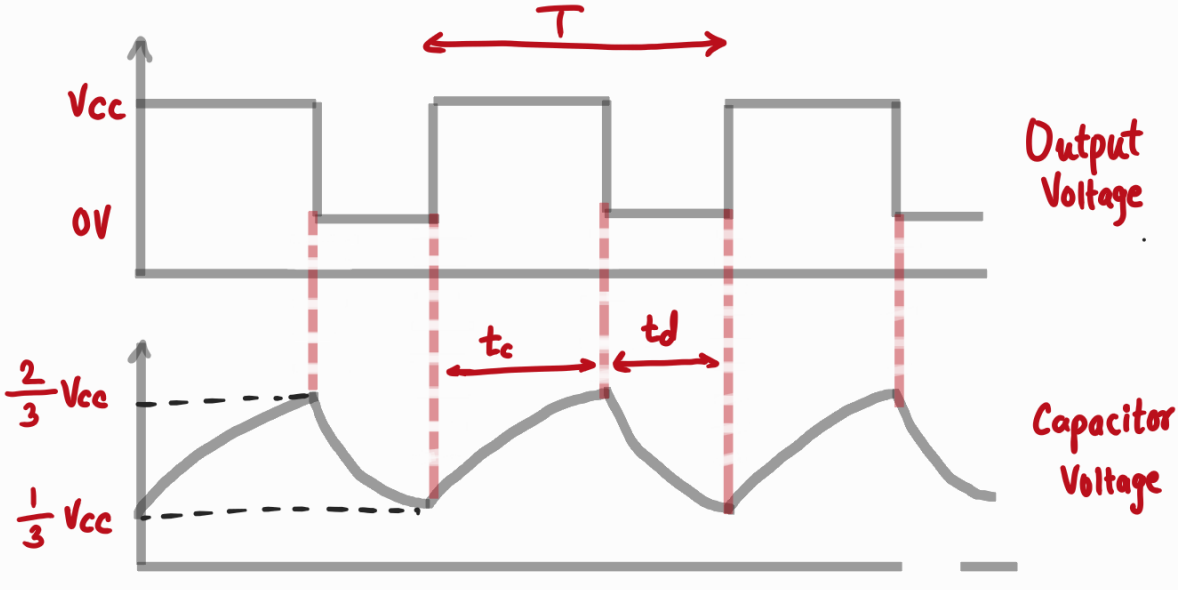
555 timer as an Astable Multivibrator

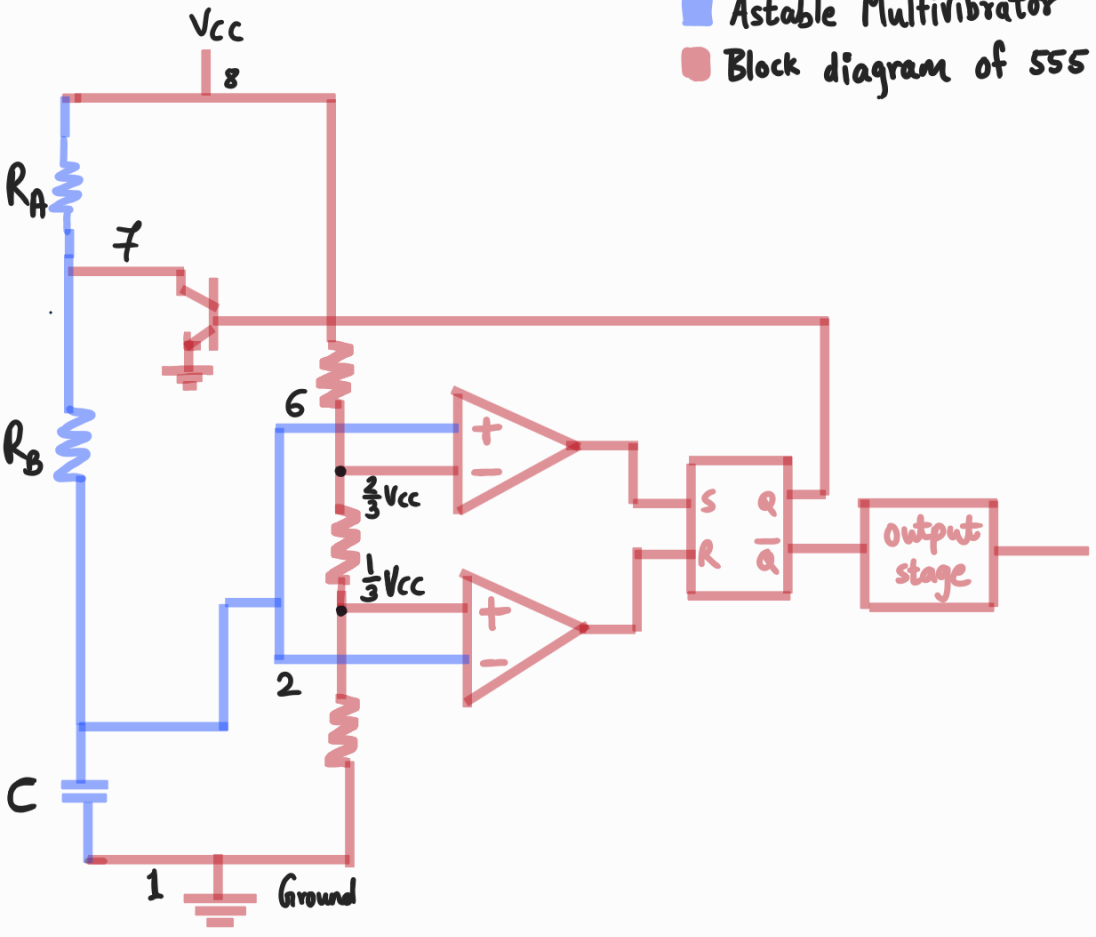
- free running
- Does not require external trigger



Circuit Diagram



Astable Multivibrator
Block diagram of 555



Output = High

Q = 0
Q̄ = 1

Transistor was open

capacitor charges (through RA & RB)

When Vc > 2/3 Vcc

Vo = Vsat

Q = 1
Q̄ = 0

Output = Low

Transistor is short circuit (Q is base of tr)

Capacitor discharges through RB

When Vc < 1/3 Vcc

Vo = Vsat

Q = 0
Q̄ = 1

Initially output = High

C starts charging toward Vcc through R_A and R_B

when $V_c = \frac{2}{3} V_{cc}$

Comparator 1 output = High

flip flop sets (S = 1)

$Q = 1 \quad \bar{Q} = 0$

Output = $\bar{Q}$ = 0 (Low)

Capacitor C starts discharging through R_B and transistor

when $V_c = \frac{1}{3} V_{cc}$

comparator 2 o/p = 1

ff resets $Q = 0 \quad \bar{Q} = 1$

Output = 1 (High)

Charging time $= t_c = 0.69(R_A + R_B)C$

Discharging time $= t_d = 0.69(R_B)C$

$$T = t_c + t_d = 0.69(R_A + 2R_B)C$$

frequency of oscillations $= f_o = \frac{1}{T} = \frac{1.45}{(R_A + 2R_B)C}$

$$\text{Duty cycle} = \frac{t_c}{T} \times 100$$

$$= \frac{R_A + R_B}{R_A + 2R_B}(100)$$