CPE201
Digital Design

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Class 19: Vibrators

University of Nevada, Reno

More Multivibrators

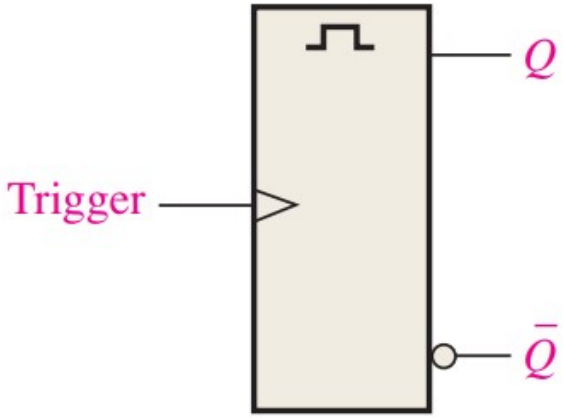
- Monostable
  - One stable state
  - One-Shots and Timers
- Astable
  - No stable states
  - Oscillators

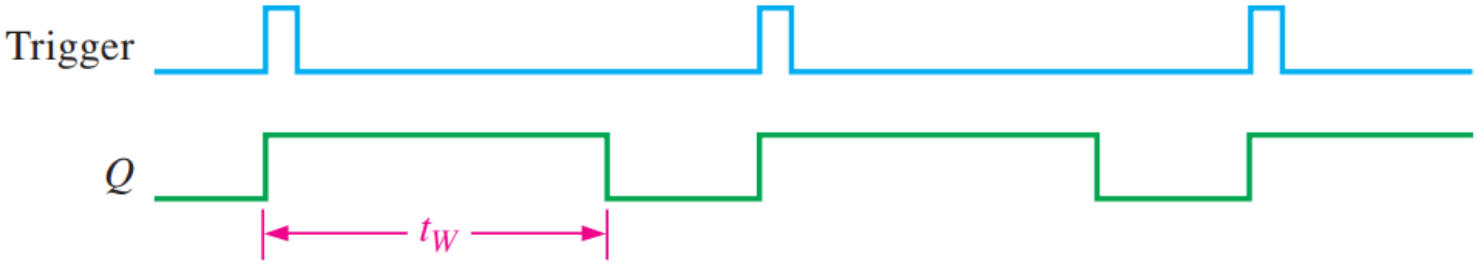
One-Shot

- Normally in its stable state
  - Trigger to unstable state
  - Returns to stable state after some time
    - Puts out a pulse of fixed width

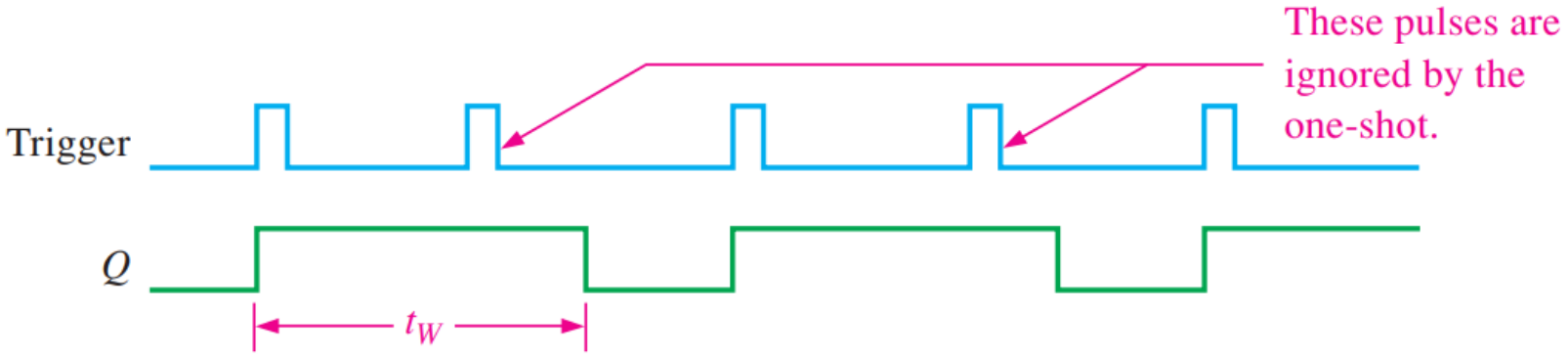
One-Shot

- t_W = pulse width

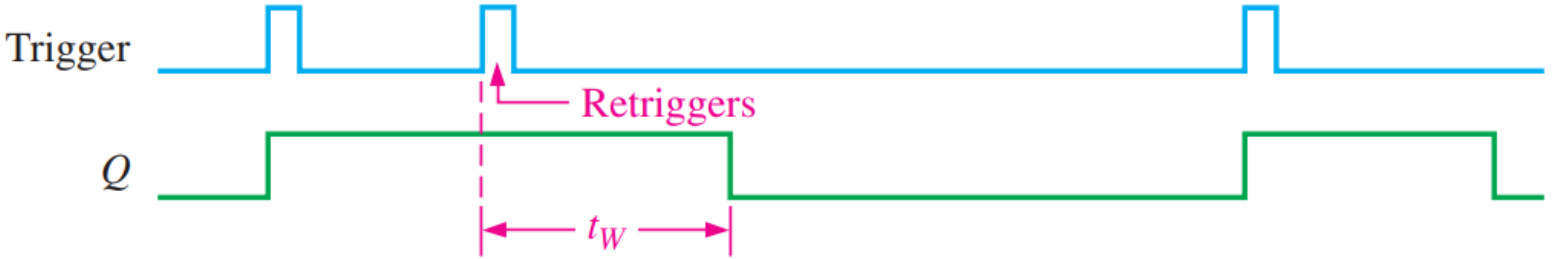




- Nonretriggerable

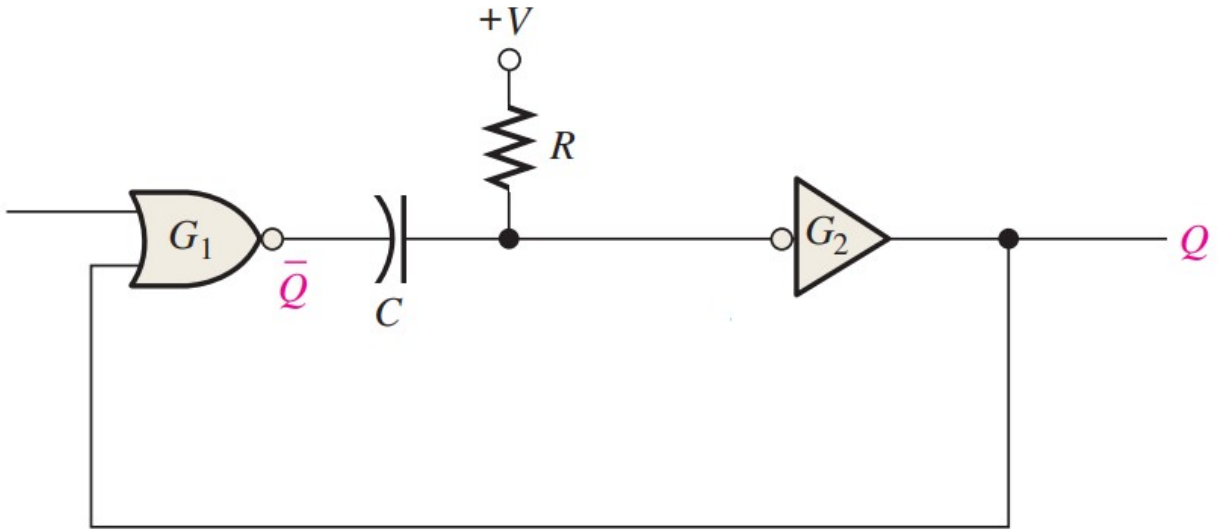


- Retriggerable



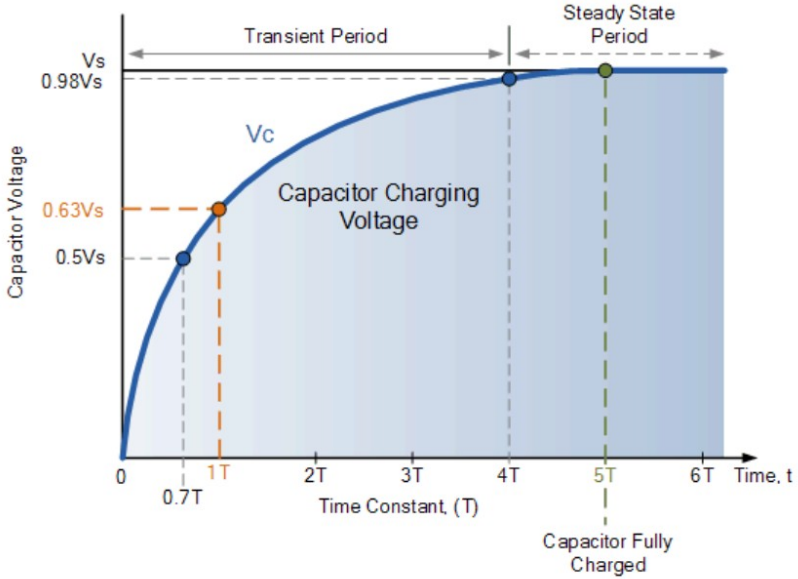
Circuit

- Capacitor (F)
- Resistor (Ω)



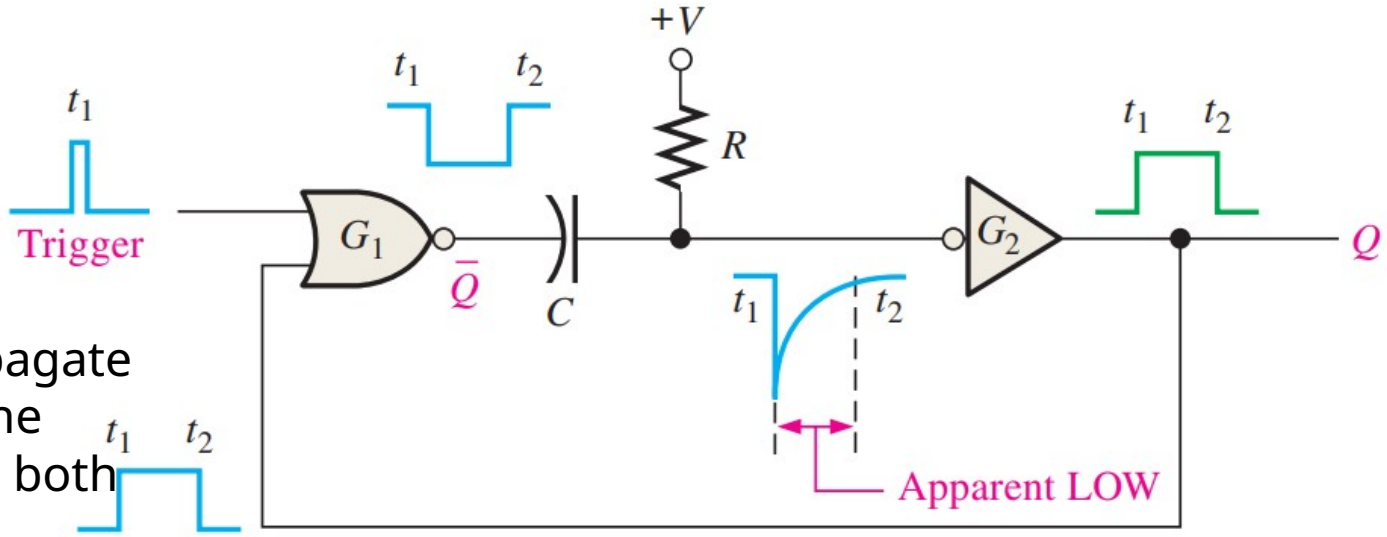
RC Time Constant

- RC = seconds
- Vs = supply voltage



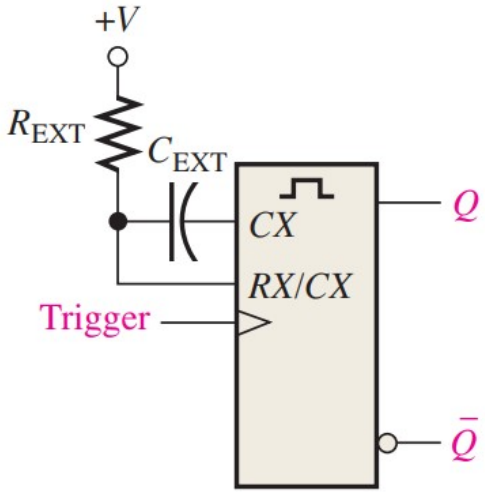
Circuit

Trigger is wide enough to propagate the input 1 to the output through both gates



Configure Pulse Width

- $t_W = 0.7R_{EXT}C_{EXT}$
- R_{EXT} in kΩ (10^3)
- C_{EXT} in pF (10^{-12})
- t_W in ns (10^{-9})
  - Corresponds to parts in the MHz frequencies



Examples

- If R = 42kΩ and C = 12pF

  $t_W = 0.7RC = 0.7 * 42 * 12 = 352.8ns$

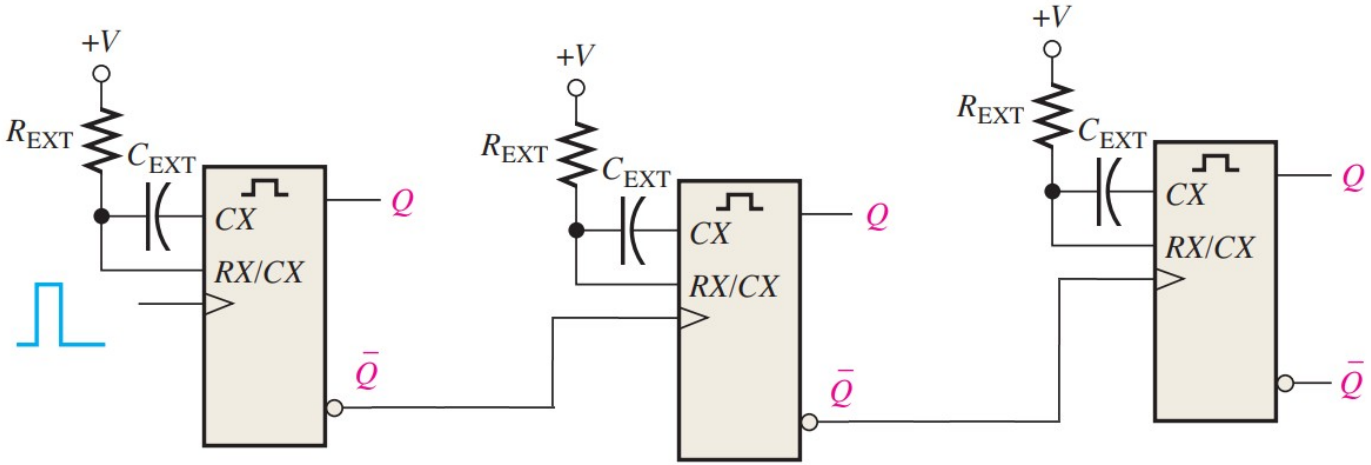
OR $t_W = 0.7 * 42E3 * 12E\text{-}12 = 352.8E\text{-}9$

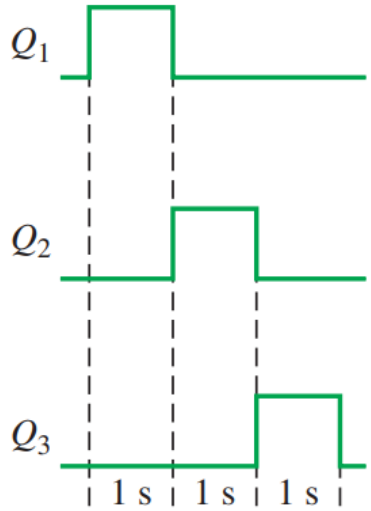
- If we want t_W = 1ms = 1E-3 and R = 1E3

  $C = t_W / (0.7 * R) = 1E\text{-}3 / (0.7 * 1E3) =$ 1.42µF

Application

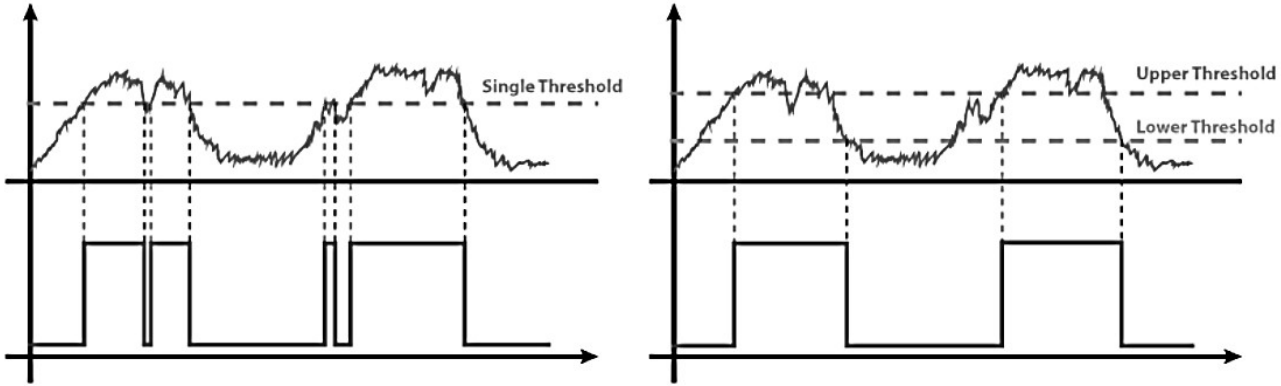
- Pulse sequence



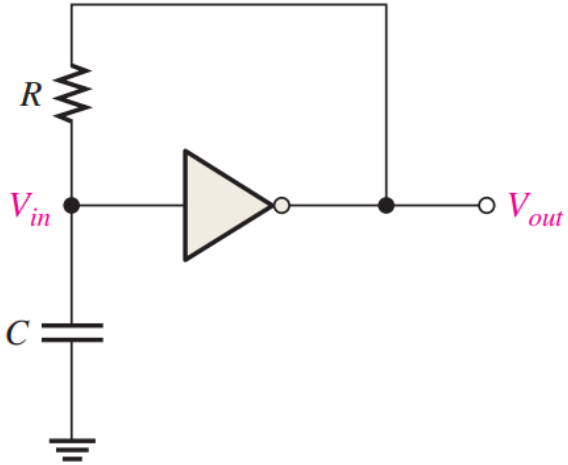


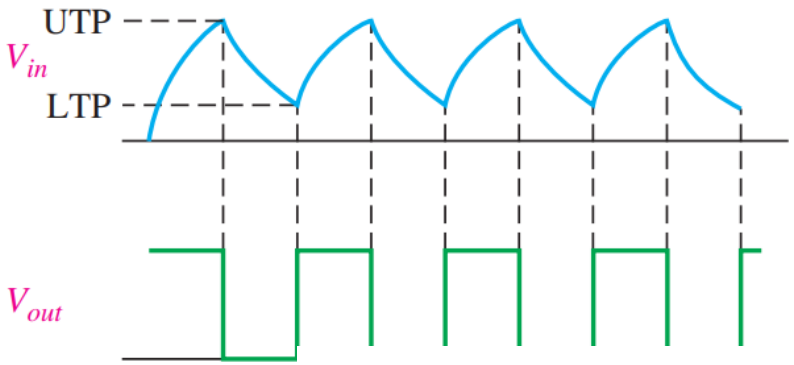
Hysteresis

- Comparator+
  - Change threshold moves after it is crossed

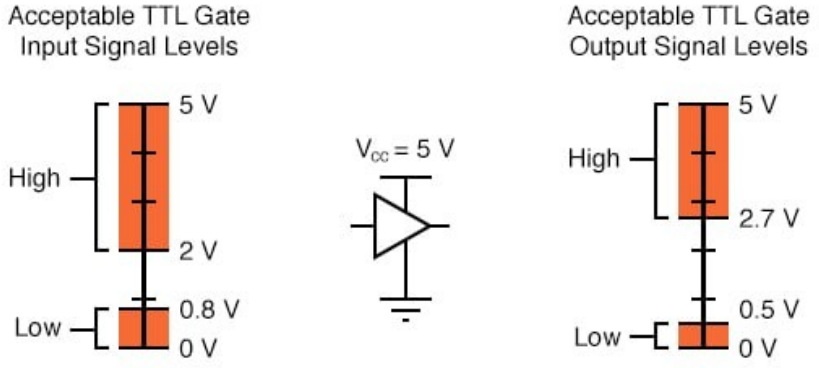


Oscillator





UTP = 2V
LTP = 0.8V



Reading

- This lecture
  - Sections 7.5-7.7
- Next lecture
  - Sections 8.1-8.3