Lab-15

One-Shot (Monostable)

Objectives

- Understand the fundamental of one shot or monostable multivibrator.
- Understand the fundamental of a one shot based on timer 555.
- Applications based on 555 one-shot in series.
- Understand the fundamental of a one shot based on TTL 74121.
- Applications based on 74121 one-shot in series.
What is One-Shot

- \( V_{out} \) output a voltage for a time \( T \), if a signal is triggered once to the input.

![One-Shot (Monostable)](image)

555 Timer

- **U1**: 5V~15V
- **GND(1)**: 0V
- **OUT(3)**: 0V or VCC
- **RST(Reset)(4)**: if \( \text{RST}=0V \), \( \text{OUT}=0V \)
  - \( \text{RST}=\text{Vcc} \) if normal state
- **THR(Threshold)(6)**: if \( \text{THR} \geq \frac{2}{3} \text{Vcc} \), then \( \text{OUT}=0V \) by via DIS (discharge)(7)
- **TRI(Trigger)(2)**: if \( \text{TRI} \leq \frac{1}{3} \text{Vcc} \), then \( \text{OUT}=\text{Vcc} \)
- **Con(Control voltage)(5)**: Connect 0.1\( \mu \)F to GND

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One-Shot based on 555

Vout: 0V-5V-0V Pulse
Vc1: 0V → 2/3*5V → 0V exponential wave

\[ T = 1.1 \times R1 \times C1 \]
\[ = 1.1 \times 5k \times 47 \mu \]
\[ = 258.5 \text{ms} \]

555 One-Shot Applications

\[ VCC \]
\[ 5V \]
\[ S2 \]
\[ Vout \]
\[ T \]
One-Shot to Turn on a Lamp

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Relay

DC-6V Relay

DC-5V Relay

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555 One-Shot in Series

Traffic Signal based on 555 One-Shot
One-Shot based on 74121

<table>
<thead>
<tr>
<th>/A1</th>
<th>/A2</th>
<th>B</th>
<th>Q</th>
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</thead>
<tbody>
<tr>
<td>1→0</td>
<td>0</td>
<td>x</td>
<td>0</td>
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<tr>
<td>1→0</td>
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<tr>
<td>1→0</td>
<td>1</td>
<td>1</td>
<td>pulse</td>
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<tr>
<td>0</td>
<td>1→0</td>
<td>x</td>
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<td>x</td>
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<td>1</td>
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<td>pulse</td>
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<td>1</td>
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<td>0→1</td>
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<td>0</td>
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<td>x</td>
<td>0</td>
<td>0→1</td>
<td>pulse</td>
</tr>
</tbody>
</table>

Two RC Choices for 74121

Q: 0V-5V-0V Pulse
T=0.693RC=0.693*5k*47μ
=162.855ms
R= 1.4kΩ~40kΩ
C=0~1000μF

Q: 0V-5V-0V Pulse
T=0.693(R+2kΩ)C
=0.693*(5k+2k)*47μ
=227.997ms
R= 1.4kΩ~40kΩ
C=0~1000μF
### 74121 One-Shot Applications

Q: 0V-5V-0V Pulse

\[ T = 0.693(R + 2k\Omega)C \]

\[ = 0.693 \times (33k + 2k) \times 100\mu \]

\[ = 2.4255s \]

R = 1.4k\Ω \text{~} 40k\Ω

C = 0-1000\µF

### 74121 One-Shot in Series

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Experiment-1 One-Shot based on 555

Vout: 0V-5V-0V Pulse
Vc1: 0V → 2/3 * 5V → 0V exponential waveform

\[ T = 1.1 \times R1 \times C1 = 1.1 \times 33k \times 100\mu = 3.53 \text{ s} \]

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Experiment-2 One-Shot based on 74121

Q: 0V-5V-0V Pulse

\[ T = 0.693 \times (R+2k) \times C = 0.693 \times (33k+2k) \times 100\mu \]
\[ = 2.4255 \text{ s} \]

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One-Shot Application: Roulette Game

Push S1 once ➔ One Shot
OUT: 0V-5V-0V Pulse
\[ T = 1.1 \times R1 \times C1 \]
\[ = 1.1 \times 33k \times 100\mu = 3.53 \text{s} \]

If RST=+5v ➔ Astable OSC
OUT: 0-5V Square wave
\[ T = 1.4 \times R1 \times C1 \]
\[ = 1.4 \times 1k \times 0.47\mu = 0.658 \text{ms} \]
\[ f = 1/T = 1/0.658 = 1.5 \text{Hz} \]

If Astable OSC is work ➔
Only one LED on one time from left to right