UNIVERSITY OF SANTO TOMAS
Faculty of Engineering
ELECTRONICS ENGINEERING DEPARTMENT
First Term, AY 2021 – 2022

EE2315 Lab: Industrial Electronics

Experiment 5: The UJT-SCR Time Delay Circuit

Intended Learning Outcomes

1. Be able to familiarize with the operation of a UJT-SCR Time Delay Circuit.
2. Be able to determine the effect of the different components on the turn ON delay time of the circuit.

Discussion

One relatively common application of the UJT is in the triggering of other devices such as the SCR. The essential elements of the triggering circuit are shown in Fig. 5.1. Like a UJT relaxation oscillator, the intersection (the Q-point) of the load line and the UJT's characteristic curve should be in the negative resistance region. Such triggering circuits can be applied to either DC or AC circuits. When used in a DC circuit, the UJT triggering circuit can adjust the time when the SCR turns ON. This will effectively add a delay time before the SCR starts conducting.

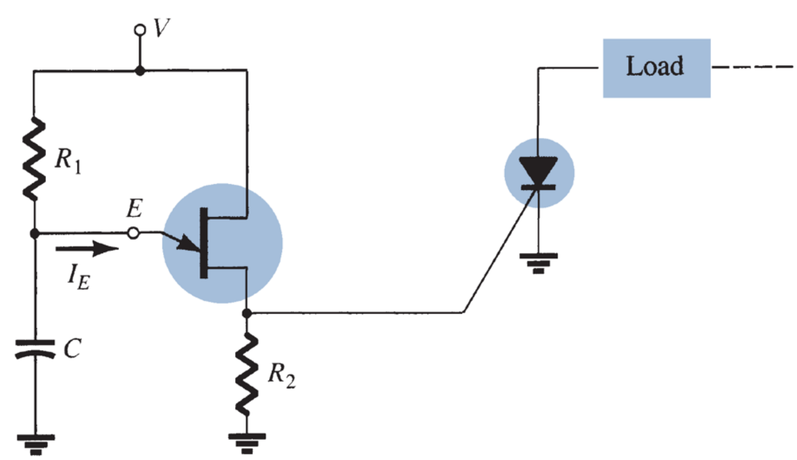


Fig. 5.1 UJT triggering circuit connected to an SCR.

Materials

LTSpice Simulator

Experiment Proper

Part A.

1. Construct the UJT-SCR time delay circuit shown in Fig. 5.2. (Do not forget to include the model file for the SCR by using the **.include** command)

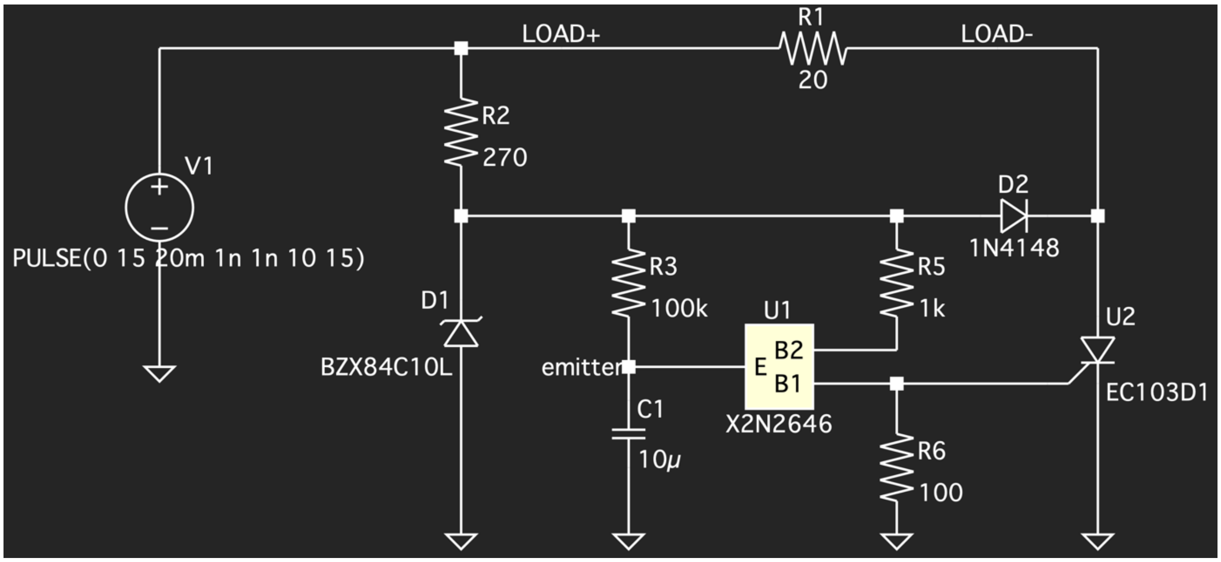
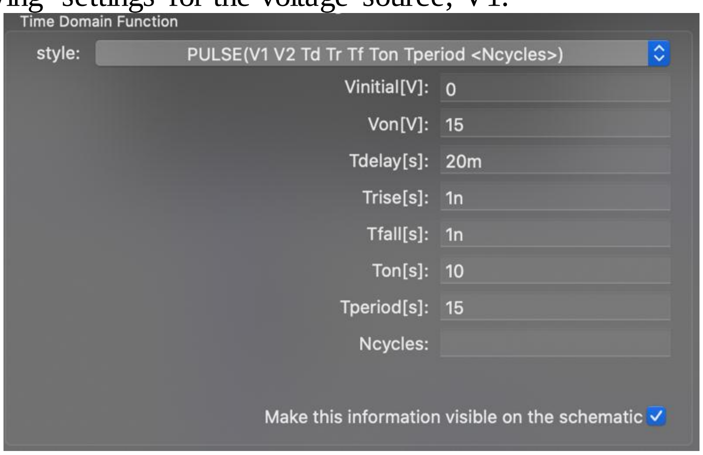


Fig. 5.2. Experimental UJT-SCR Time Delay Circuit.

2. Use the following settings for the voltage source, V1:



3. To ensure that the initial voltage at the capacitor is zero, include the statement below:

.IC v(emitter)=0

4. Run a **2 second** transient simulation using **.tran** command.
5. **Using different plot panes,** plot the voltage across the voltage source V1, the voltage across the load (R1), the SCR's anode to cathode voltage, and the UJT's emitter voltage.

By observing the waveforms, explain the operation of the circuit.

Part B

1. Vary the resistor R2 in accordance to Table 5.1 (GR Format) and perform a 2-second transient simulation for each.
2. **Using different plot panes,** plot the voltage across the load (R1), the SCR's anode to cathode voltage, the emitter voltage, and the zener voltage for each case.
3. Measure the delay by measuring the charging time of the capacitor from zero to V_P. (Use cursor)

   Guide Question: What is the effect of the resistor R2 to the delay in the circuit? It would be better if you could explain its effect to the delay time.

Part C

1. Revert the value of R2 back to 270 after performing Procedure B.
2. Vary the R_3C_1 time constant by varying the resistor R3 in accordance to Table 5.2 and perform a 2-second transient simulation for each case.
3. **Using different plot panes,** plot the voltage across the load (R1), the SCR's anode to cathode voltage and the emitter voltage for each case.
4. Measure the delay by measuring the charging time of the capacitor from zero to V_P. (Use cursor)

   Guide Question: What is the effect of the resistor R3 to the delay in the circuit? It would be better if you could explain its effect to the delay time.

Part D:

1. Revert the value of R3 back to 100k after performing Procedure C.
2. Vary the resistor, R6, in accordance to Table 5.3 and perform a 2-second transient simulation for each case.
3. **Using different plot panes,** plot the voltage across the load (R1), the SCR's anode to cathode voltage and the emitter voltage for each case.
4. Measure the delay (if there's any) by measuring the charging time of the capacitor from zero to V_P. (Use cursor)

   Explain why we do we need to have a proper value of R6.

· End of Experiment 5 ·

Group Report Format:

Group No.: ____________________
Group Members: ________________
____
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Part A:
Plot of Part A Simulations (Step 5):

<Insert Plot Here>

Observation and explanation:

<Insert Explanation Here>

Part B:
Plot of Part B Simulations (Step 2):

When $R_2 = 270\Omega$:

<Insert Plot Here>

When $R_2 = 500\Omega$:

<Insert Plot Here>

When $R_2 = 1k\Omega$:

<Insert Plot Here>

When $R_2 = 3k\Omega$:

<Insert Plot Here>

When $R_2 = 5k\Omega$:

<Insert Plot Here>

Table 5.1

R_2	t_{delay}
270Ω	
500Ω	
1kΩ	
3kΩ	
5kΩ	

Answer to the Guide Question:

<Insert Answer Here>

Part C:
Plot of Part C Simulations (Step 3):

When $R_3 = 10k\Omega$:

<Insert Plot Here>

When $R_3 = 20k\Omega$:

<Insert Plot Here>

When $R_3 = 30k\Omega$:

<Insert Plot Here>

When $R_3 = 40k\Omega$:

<Insert Plot Here>

When $R_3 = 50k\Omega$:

<Insert Plot Here>

When $R_3 = 80k\Omega$:

<Insert Plot Here>

Table 5.2

R_3	t_{delay}
10kΩ	
20kΩ	
30kΩ	
40kΩ	
50kΩ	

80kΩ	

Answer to the Guide Question:

<Insert Answer Here>

Part D:
Plot of Part D Simulations (Step 3):

When $R_6 = 1\Omega$:

<Insert Plot Here>

When $R_6 = 10\Omega$:

<Insert Plot Here>

When $R_6 = 50\Omega$:

<Insert Plot Here>

When $R_6 = 200\Omega$:

<Insert Plot Here>

When $R_6 = 800\Omega$:

<Insert Plot Here>

When $R_6 = 1k\Omega$:

<Insert Plot Here>

Table 5.3

R6	t_{delay}
1Ω	
10Ω	
50Ω	
200Ω	
800Ω	
1kΩ	

Explanation:

<Insert Explanation Here>

Conclusion:

<Inset Conclusion Here>