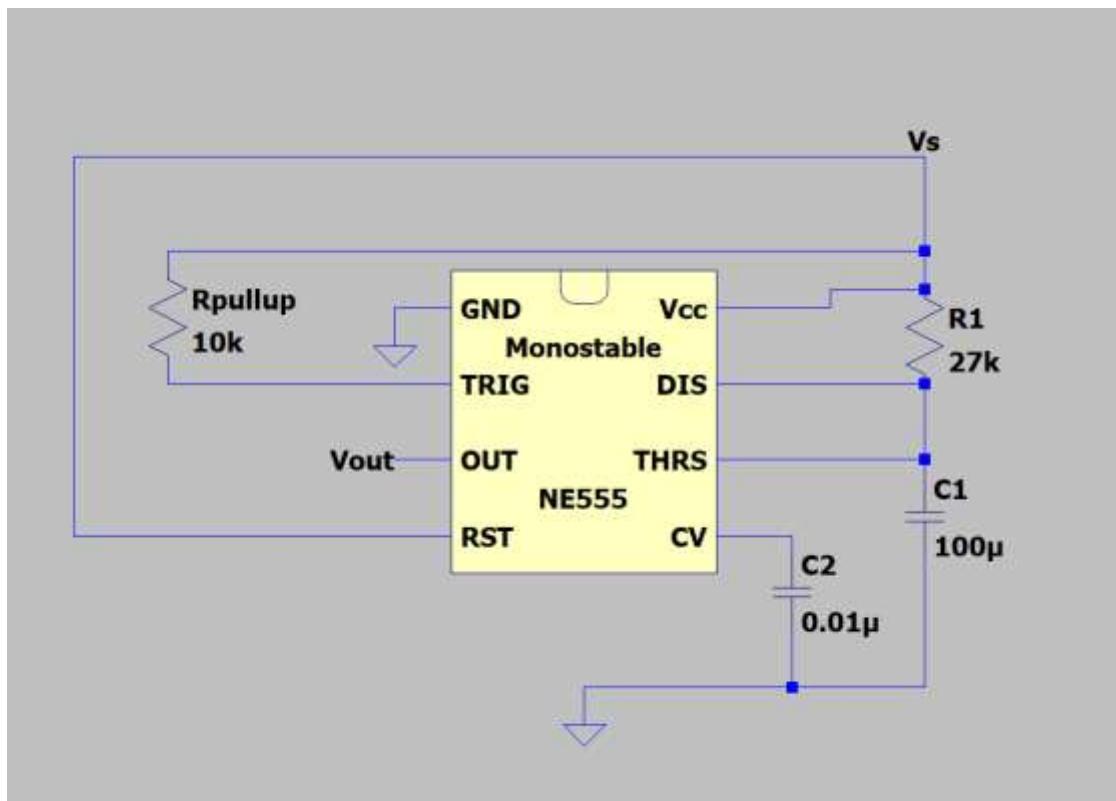


General use of a 555 Timer**Monostable Circuit (3s on)**

$$T = 1.1RC$$

$3 \text{ sec} = 1.1 \text{ RC}$; from lab kit use a $100 \mu\text{F}$ capacitor with a $27\text{k} \Omega$ Resistor

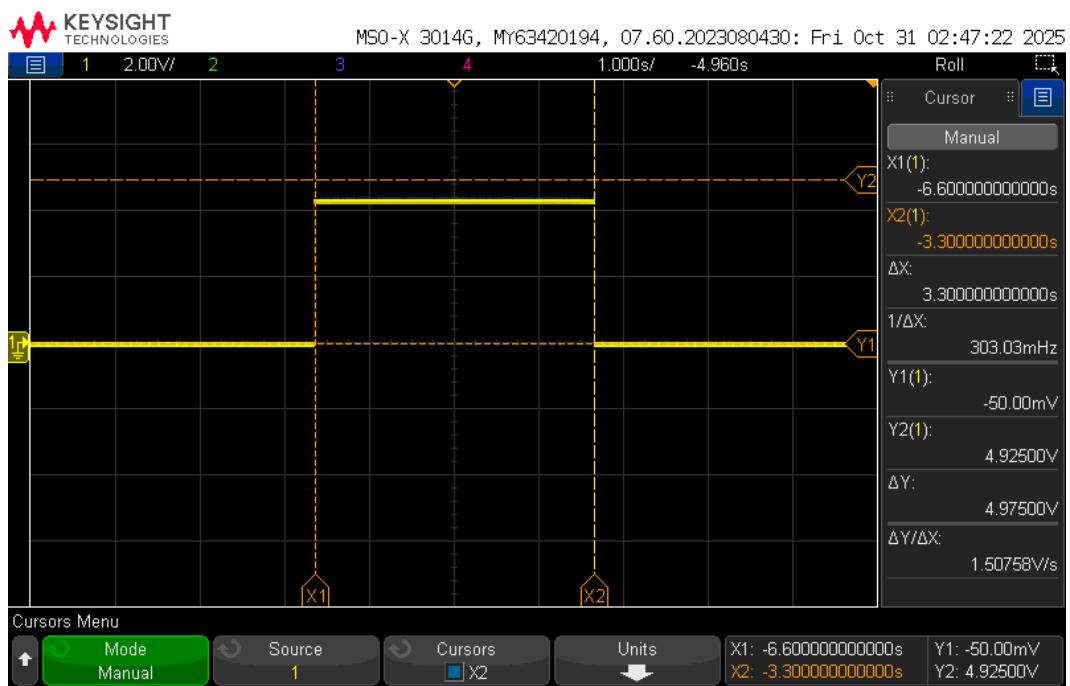
$$T = 1.1 * 27\text{k} \Omega * 100 \mu\text{F} = 2.97 \text{ seconds} \approx 3 \text{ seconds}$$



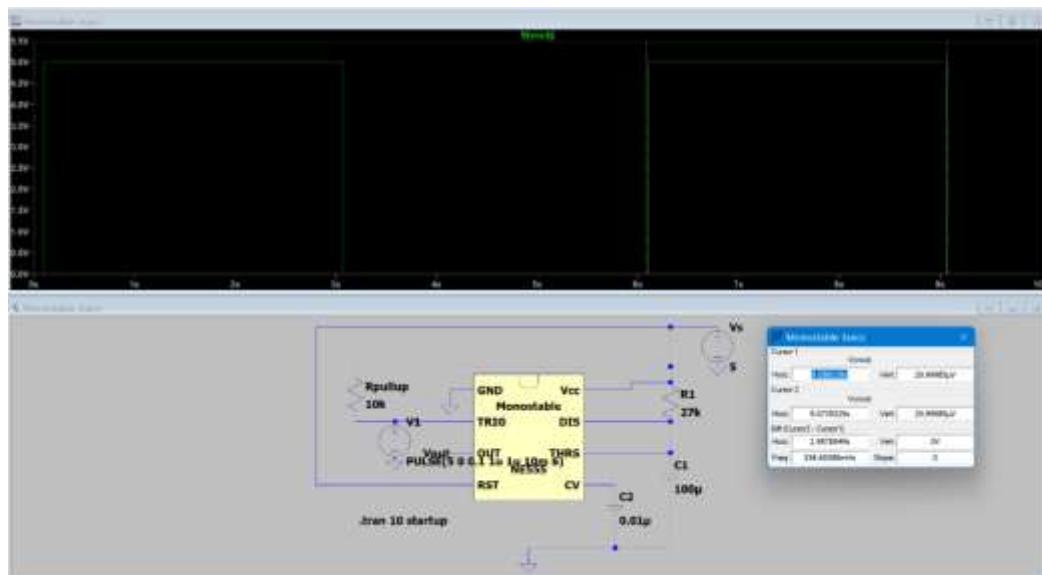
Monostable 555 Timer Circuit Schematic (3 second period)

Calculated Period (s)	Simulated Period (s)	Experimental Period (s)	Percent Error (%)
2.97	2.99	3.30	11.1

3-second Monostable Circuit Measurements



Monostable 555 Timer Circuit (3 second period)



LTSpice Monostable 555 Timer Circuit (3 second period) Simulation

Astable Circuit (2s Period)

$$T = 0.693(R_a + 2R_b)C$$

$$\text{Duty Cycle} = (R_a + R_b) / (R_a + 2R_b)$$

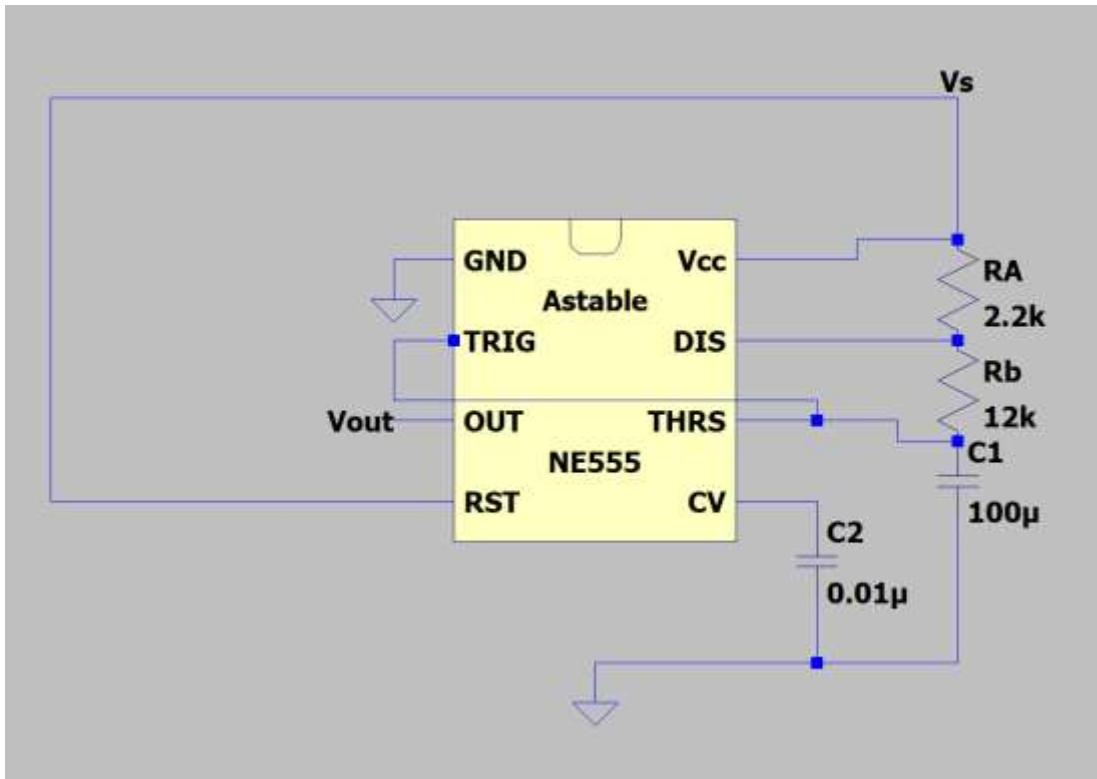
Choose $C = 100 \mu\text{F}$, then $R_a = 2.2 \text{ k}\Omega$, $R_b = 12.2 \text{ k}\Omega$,

$$T = 0.693(2200 + 2(12200)) * (0.0001) = 1.843 \text{ s} \approx 2 \text{ s}$$

$$\text{Duty Cycle} = (2200 + 12200) / (2200 + 2(12200)) = 54.1\% \approx 60\%$$

$$\text{Time High} = 0.541 * 1.843 = 1.000 \text{ s}$$

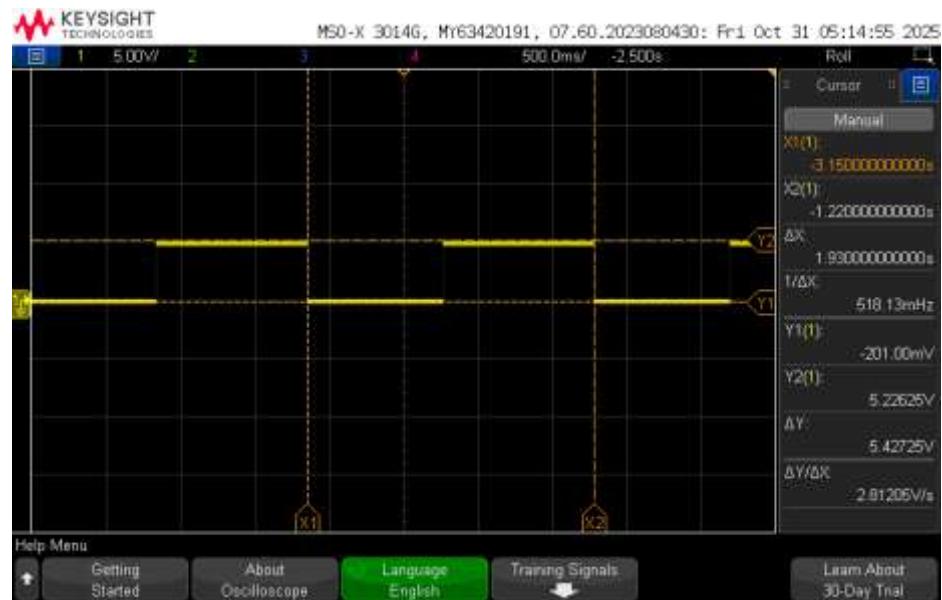
$$\text{Time Low} = 0.843 \text{ s}$$



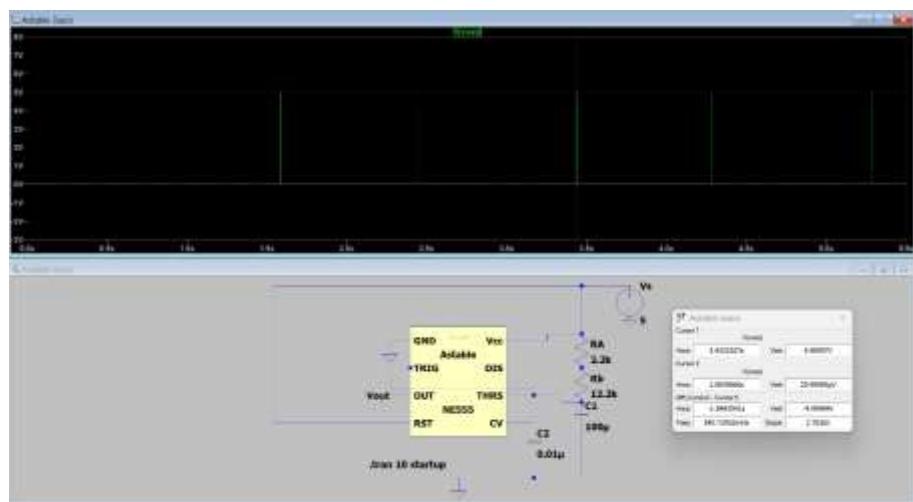
Astable 555 Timer Circuit Schematic (2 second period, 60% Duty Cycle)

Voltage	Calculated Period (s)	Simulated Period (s)	Experimental Period (s)	Percent Error (%)
High + Low	1.843	1.849	1.930	4.7
High	1.000	1.000	1.020	2.0
Low	0.843	0.849	0.910	7.9

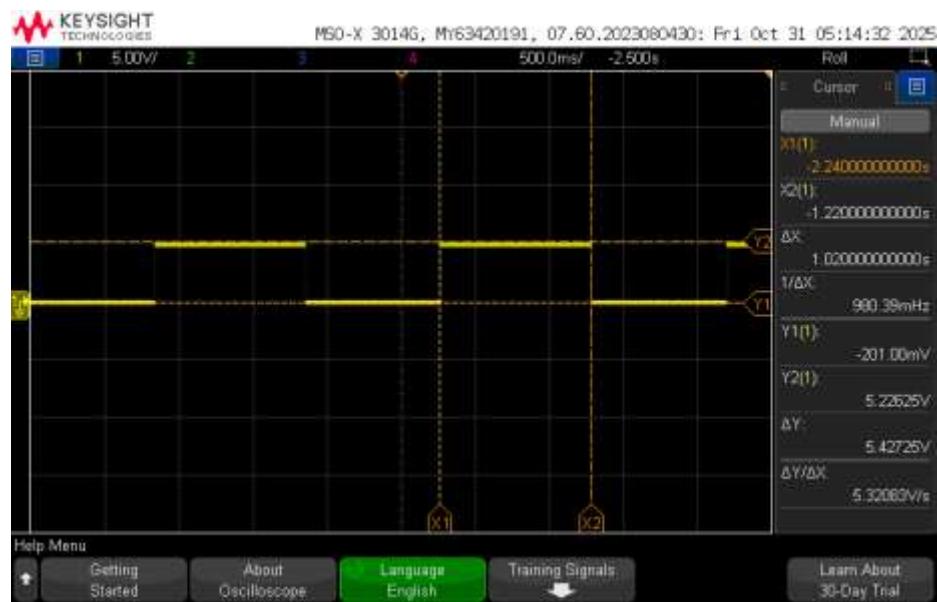
2-Second, 60% Duty Cycle Astable Circuit Measurements



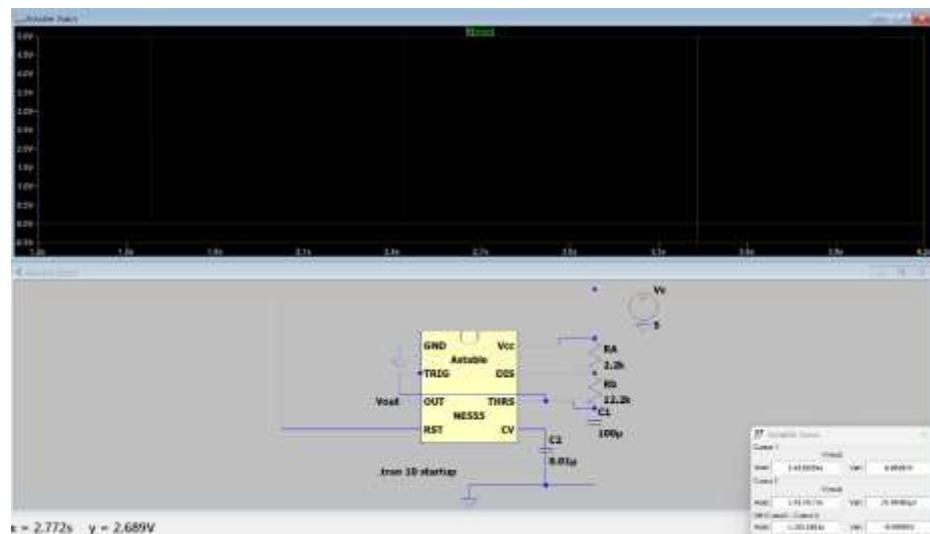
Astable 555 Timer Circuit (2 second period, 60% Duty Cycle) Full Period



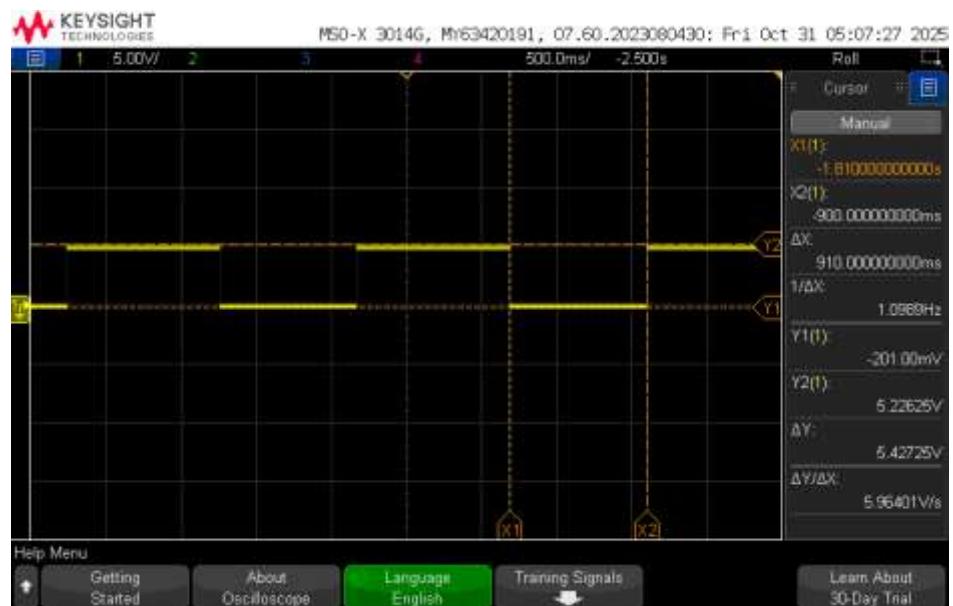
LTSpice Astable 555 Timer Circuit (2 second period, 60% Duty Cycle) Full Period Simulation



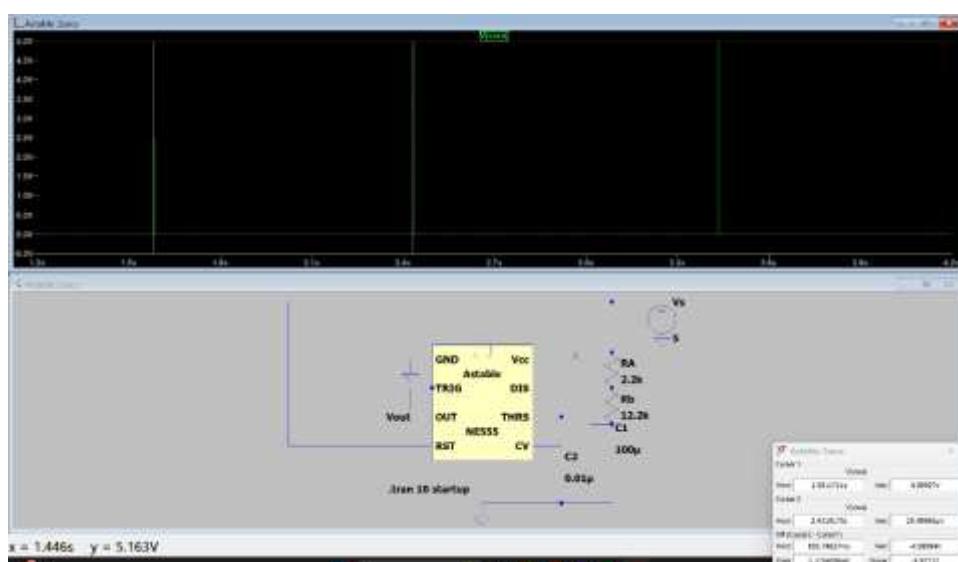
Astable 555 Timer Circuit (2 second period, 60% Duty Cycle) High Voltage Period



LTSpice Astable 555 Timer Circuit (2 second period, 60% Duty Cycle) High Voltage Period Simulation



Astable 555 Timer Circuit (2 second period, 60% Duty Cycle) Low Voltage Period



LTS spice Astable 555 Timer Circuit (2 second period, 60% Duty Cycle) Low Voltage Peirod Simulation

Astable Circuit (1s Period)

$$T = 0.693(R_a + 2R_b)C$$

$$\text{Duty Cycle} = (R_a + R_b) / (R_a + 2R_b)$$

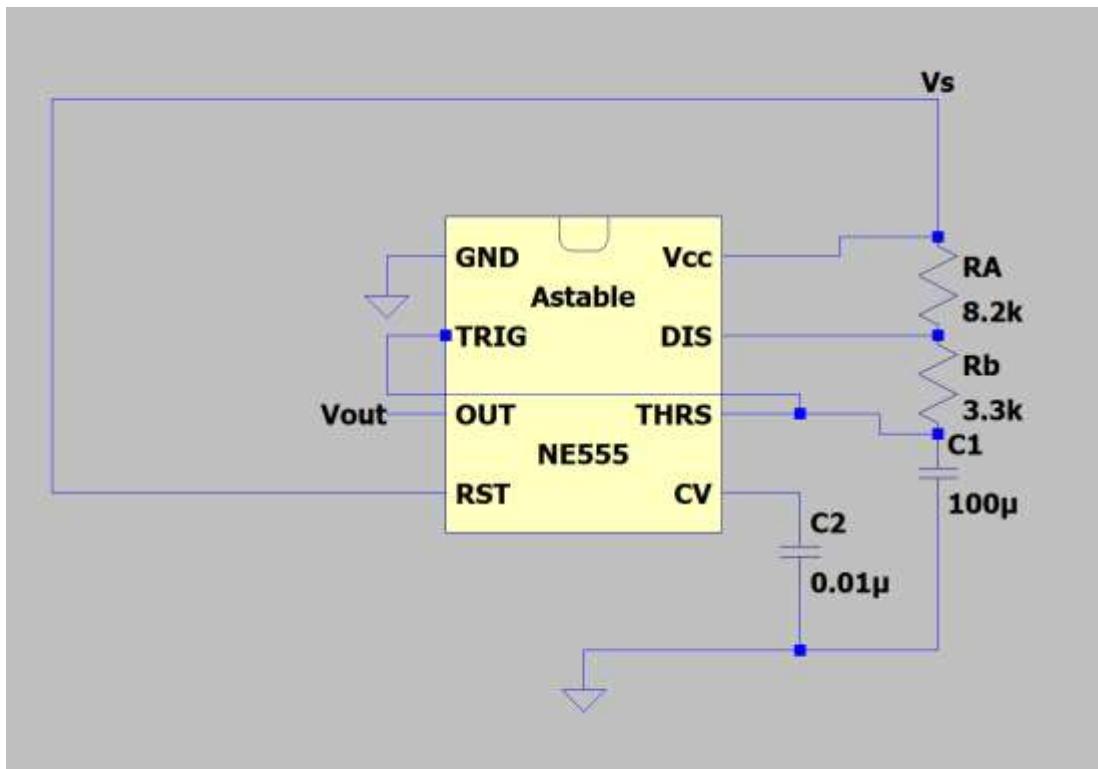
Choose $C = 100 \mu\text{F}$, then $R_a = 8.2 \text{ k}\Omega$, $R_b = 3.3 \text{ k}\Omega$,

$$T = 0.693(8200 + 2(3300)) * (0.0001) = 1.026 \text{ s} \approx 1 \text{ s}$$

$$\text{Duty Cycle} = (8200 + 3300) / (8200 + 2(3300)) = 77.7\% \approx 75\%$$

$$\text{Time High} = 0.777 * 1.026 = 0.797 \text{ s}$$

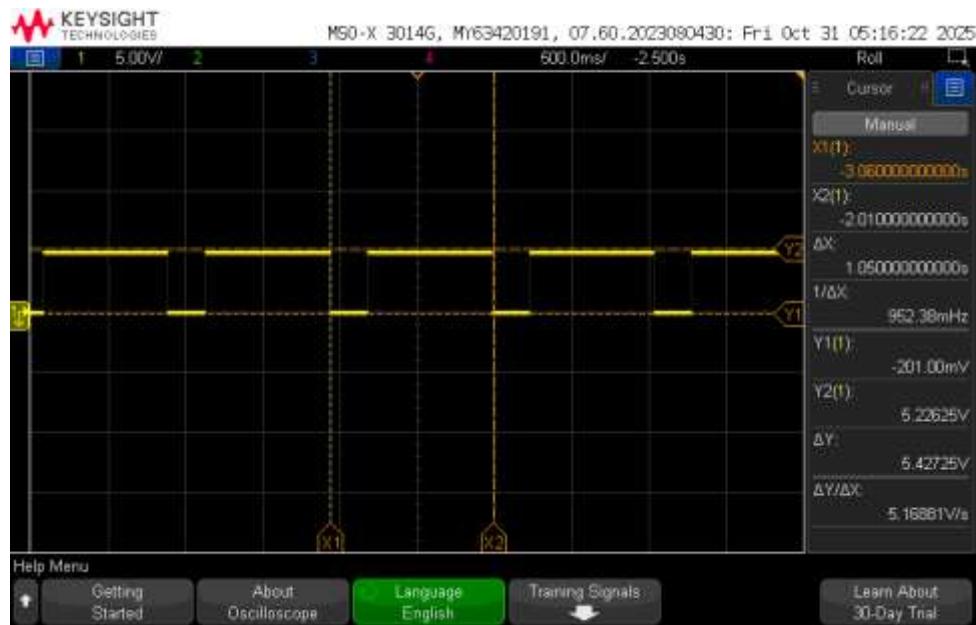
$$\text{Time Low} = 0.229 \text{ s}$$



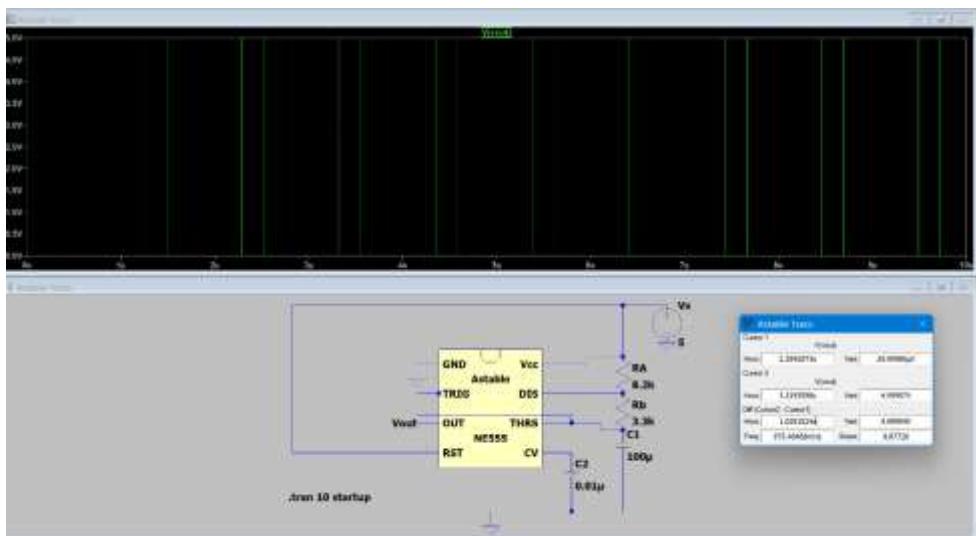
Astable 555 Timer Circuit Schematic (1 second period, 75% Duty Cycle)

Voltage	Calculated Period (s)	Simulated Period (s)	Experimental Period (s)	Percent Error (%)
High + Low	1.026	1.025	1.050	2.3
High	0.797	0.796	0.810	1.6
Low	0.229	0.229	0.240	4.8

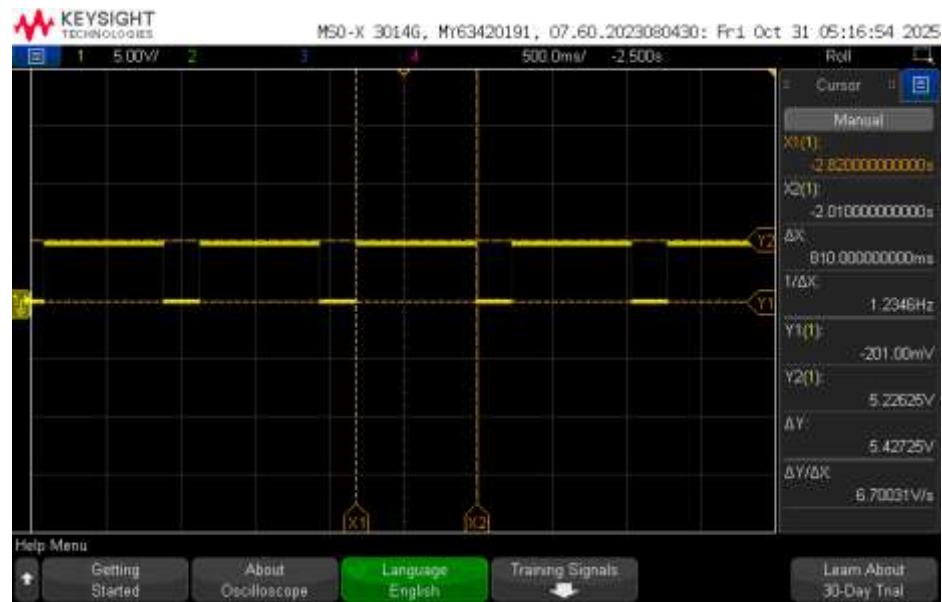
1-Second, 75% Duty Cycle Astable Circuit Measurements



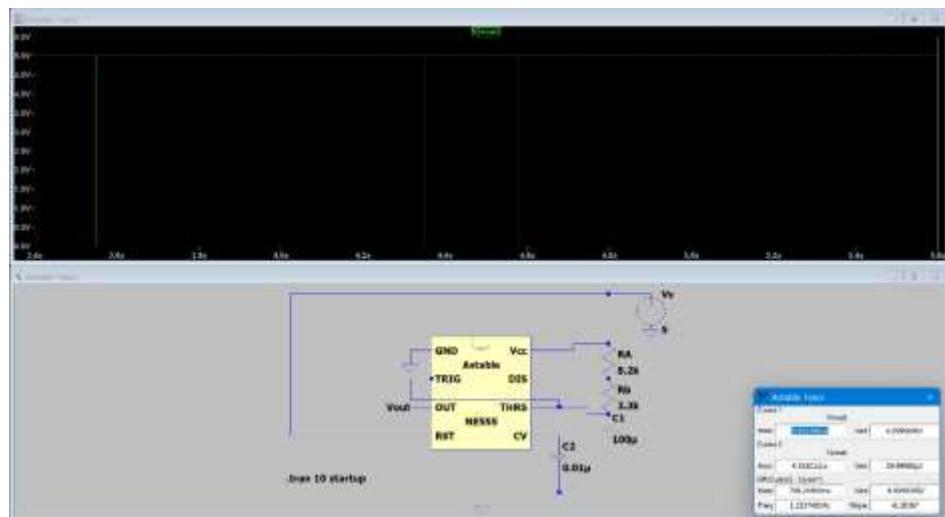
Astable 555 Timer Circuit (1 second period, 75% Duty Cycle) Full Period



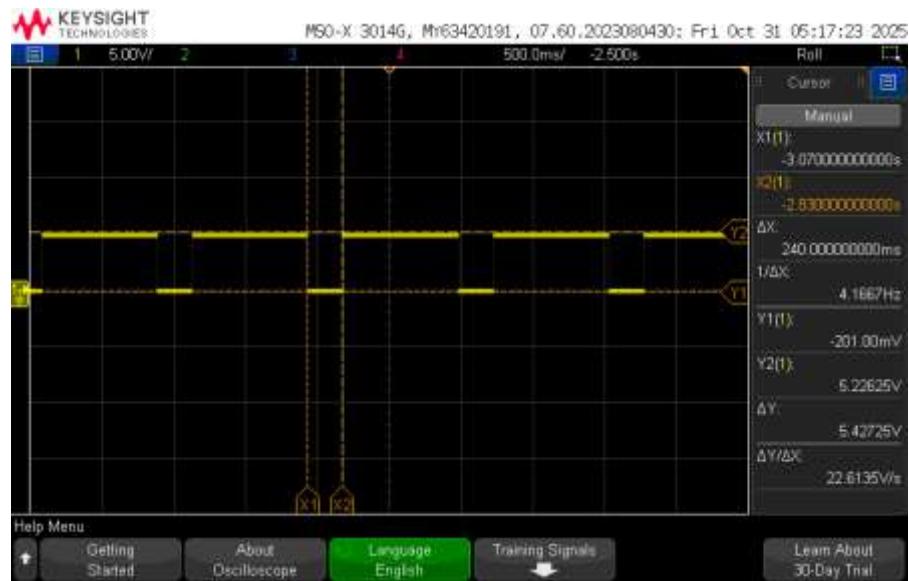
LTS defense Astable 555 Timer Circuit (1 second period, 75% Duty Cycle) Full Period Simulation



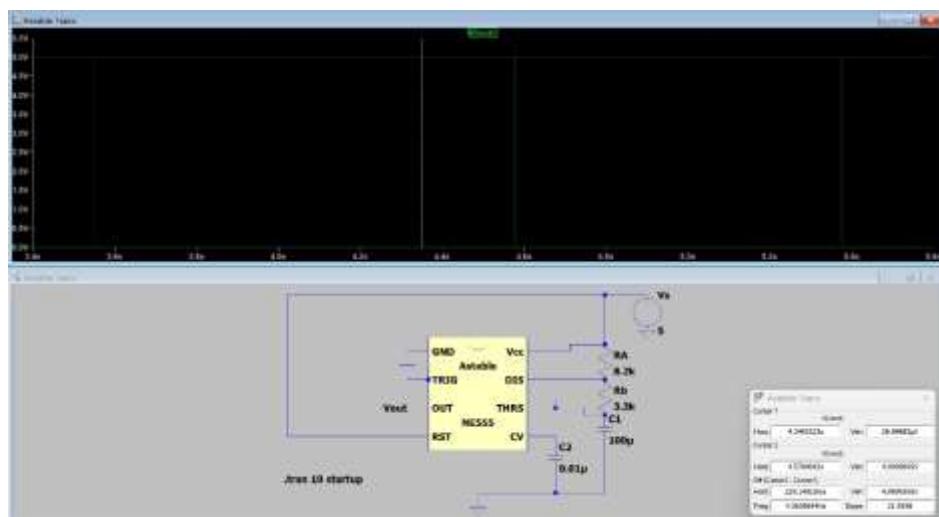
Astable 555 Timer Circuit (1 second period, 75% Duty Cycle) High Voltage Period



Astable 555 Timer Circuit (1 second period, 75% Duty Cycle) High Voltage Period Simulation



Astable 555 Timer Circuit (1 second period, 75% Duty Cycle) Low Voltage Period



LTSpice Astable 555 Timer Circuit (1 second period, 75% Duty Cycle) Low Voltage Period Simulation

LED Dimmer Application using 555 Timer

Duty cycle of the astable circuit determines the brightness of the LED. Changing the duty cycle will change the brightness of the LED allowing the potentiometer to control the brightness like a dimmable light in many rooms in industrial and residential buildings.

R_a = 1 kΩ

R_b = 10 kΩ Potentiometer (Low = 330 Ω, High is 10.3 kΩ)

C₁ and C₂ = 0.1 μF

R_{load} = 330 Ω

Time High (0.693(Rcharge + Ra)C)

Time Low (0.693(Rdischarge)C)

Finding Time Values for Full LED Brightness

Parameter Calculations

Time High (0.693(10.33k + 1k)(0.1μF)) = 0.785 ms

Time Low (0.693(0.33k)(0.1μF)) = 0.023 ms

Finding Time Values for Minimum LED Brightness

Parameter Calculations

Time High (0.693(0.33k + 1k)(0.1μF)) = 0.092 ms

Time Low (0.693(10.33k)(0.1μF)) = 0.716 ms

Finding Time Values for Medium LED Brightness

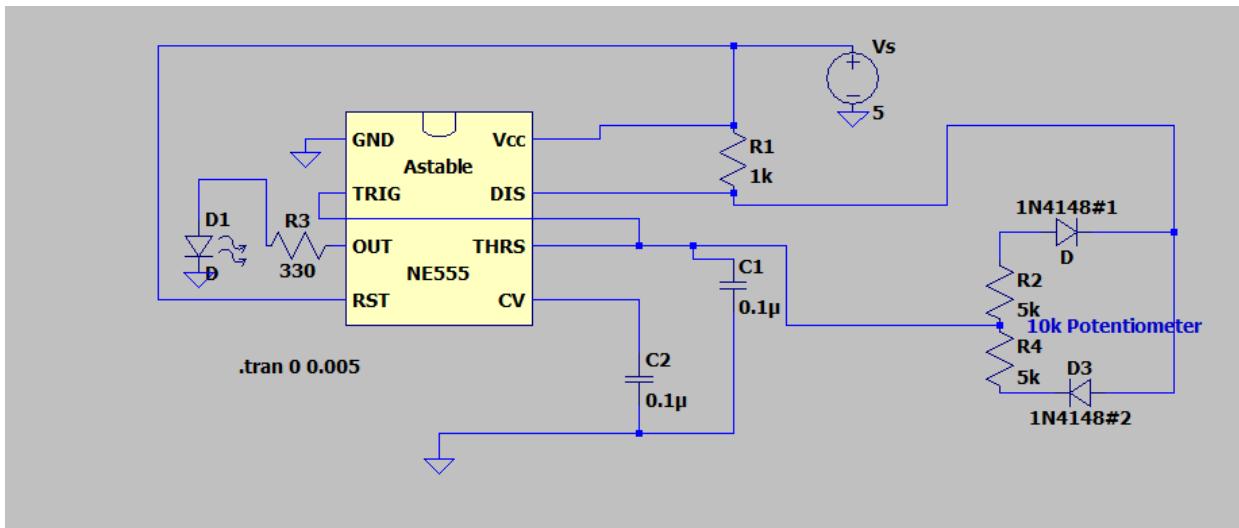
Parameter Calculations

Time High (0.693(5.33k + 1k)(0.1μF)) = 0.438 ms

Time Low (0.693(5.33k)(0.1μF)) = 0.369 ms

Duty Cycle =

Pot Position	Rcharge (kΩ)	Rdischarge (kΩ)	Time High (ms)	Time Low (ms)	Duty Cycle	Brightness
Min	0.33	10.33	0.092	0.716	11.4%	Dim
Mid	5.33	5.33	0.438	0.369	54.3%	Medium
Max	10.33	0.33	0.785	0.023	97.2%	Bright



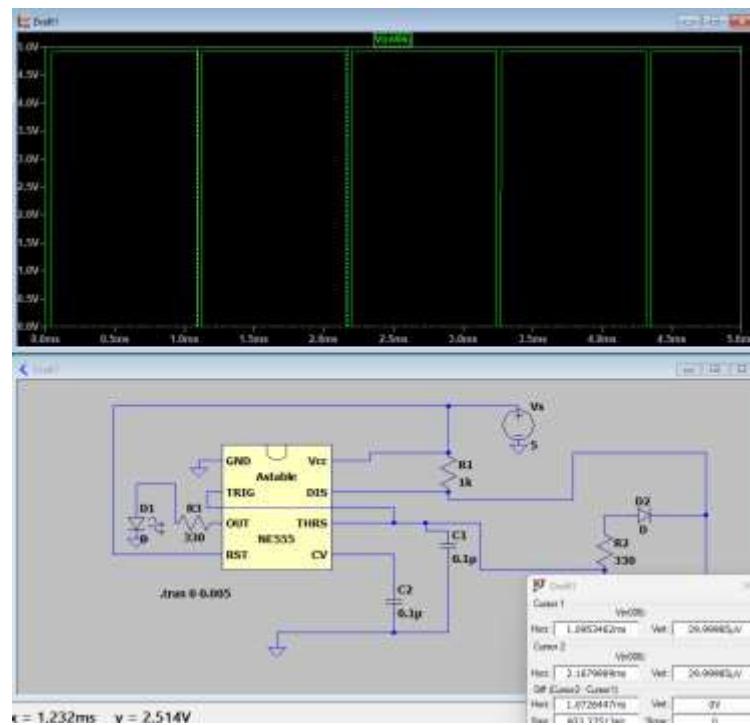
LED Dimmer Astable 555 Timer Circuit Schematic

Voltage	Calculated Period (ms)	Simulated Period (ms)	Experimental Period (ms)	Percent Error (%)
High + Low	0.808	1.070	1.500	85.6
High	0.785	1.040	1.490	89.9
Low	0.023	0.034	0.012	47.8

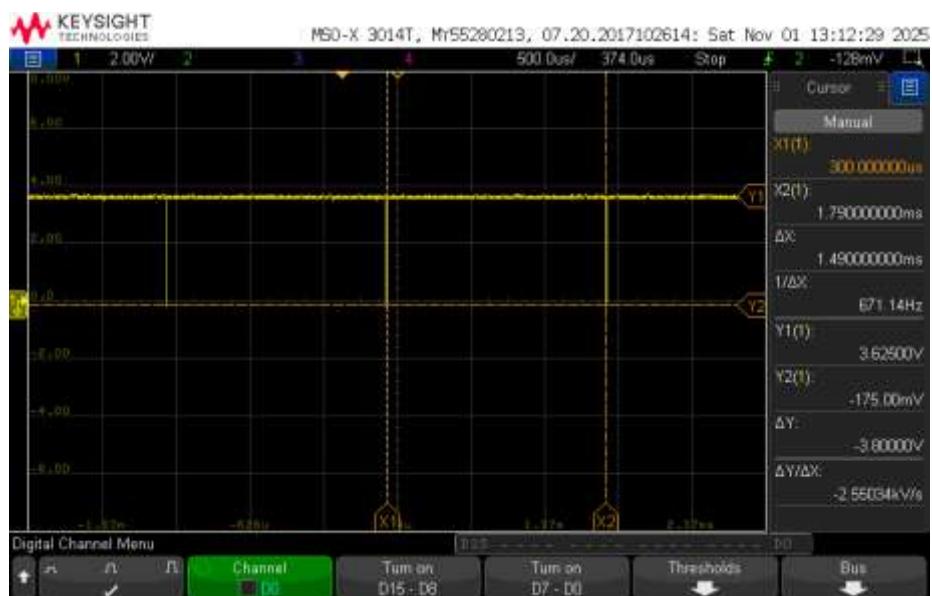
Full Brightness LED using Astable 555 Timer Circuit Measurements



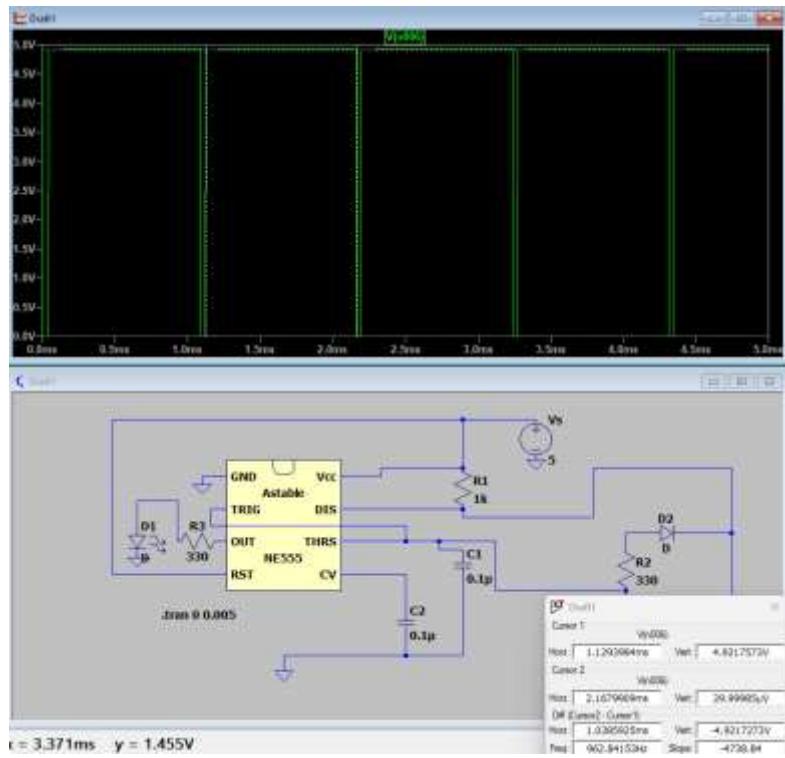
LED Dimmer Circuit using 555 Timer (Full Light, Full Period)



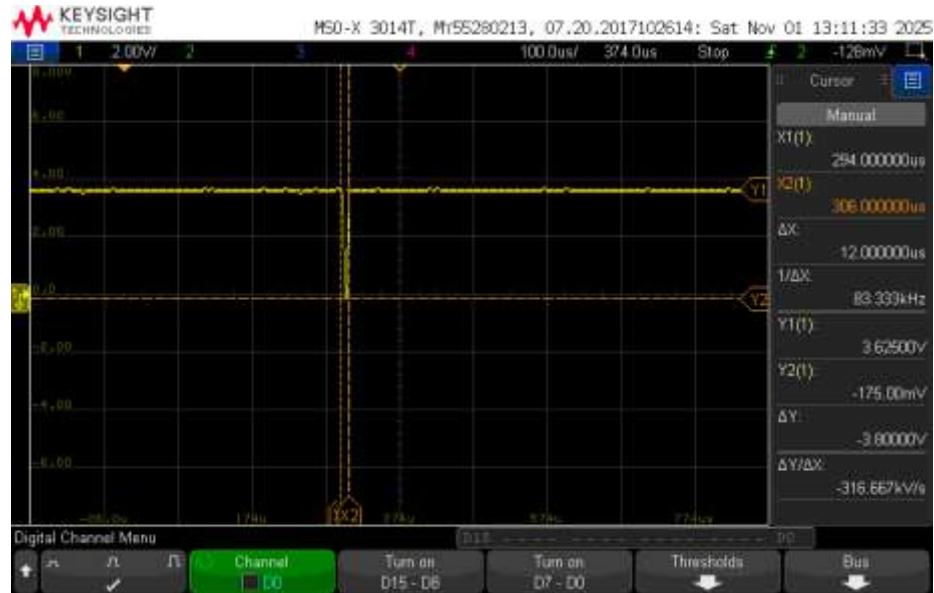
LTSpice LED Dimmer Circuit using 555 Timer (Full Light, Full Period) Simulation



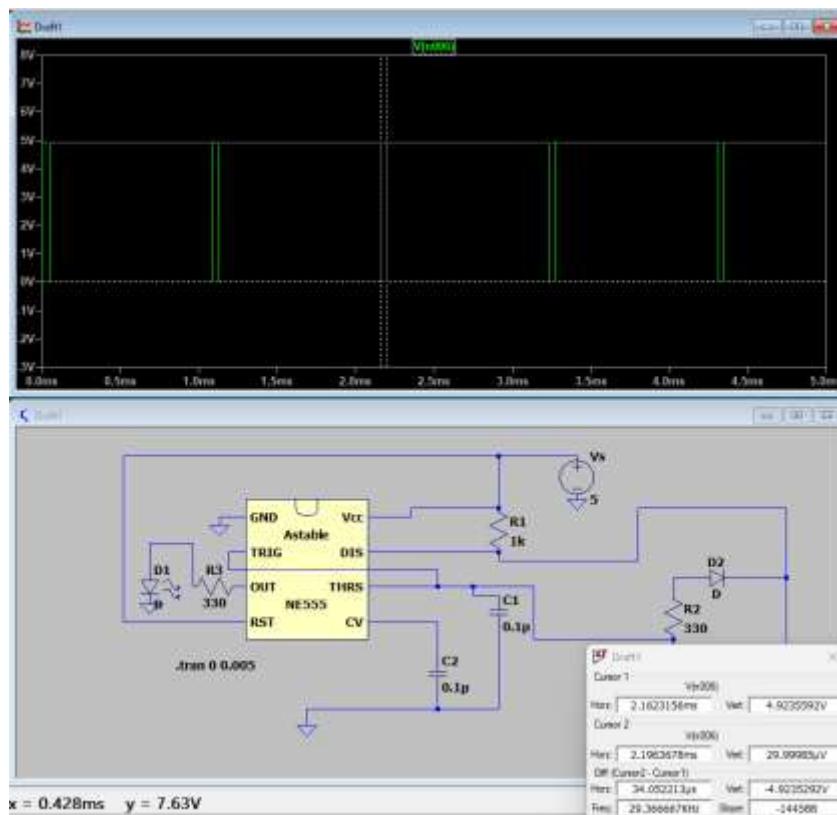
LED Dimmer Circuit using 555 Timer (Full Light, High Voltage Period)



LTSpice LED Dimmer Circuit using 555 Timer (Full Light, High Voltage Period) Simulation



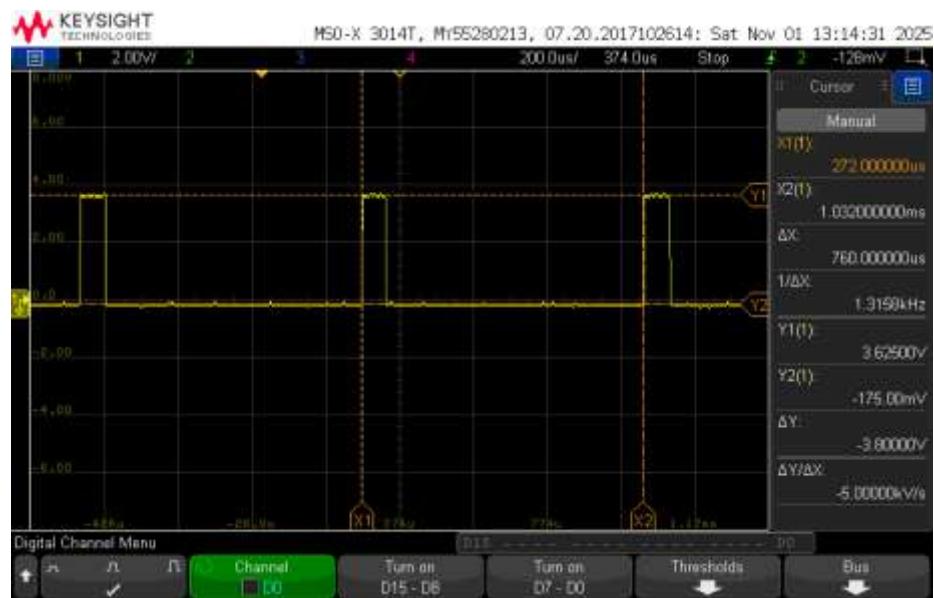
LED Dimmer Circuit using 555 Timer (Full Light, Low Voltage Period)



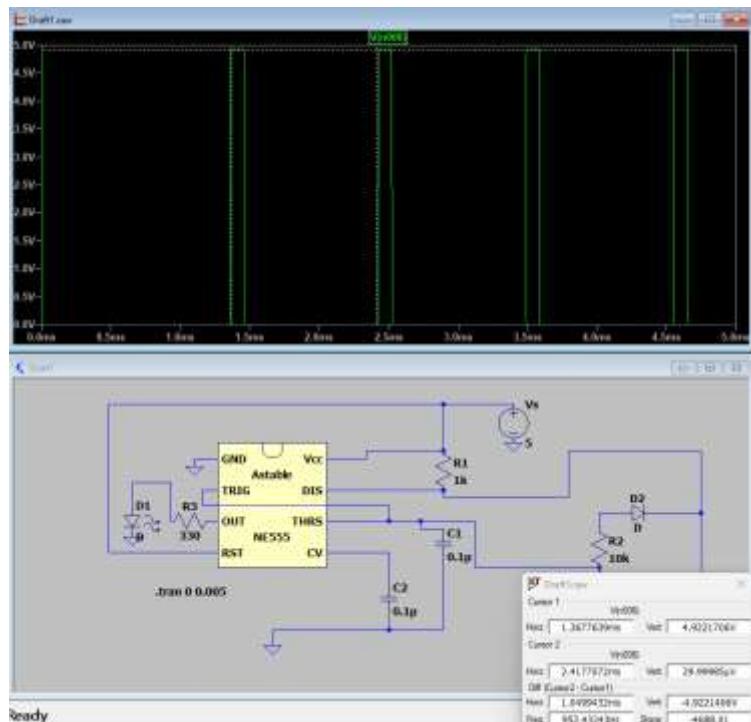
LTSpice LED Dimmer Circuit using 555 Timer (Full Light, Low Voltage Period) Simulation

Voltage	Calculated Period (ms)	Simulated Period (ms)	Experimental Period (ms)	Percent Error (%)
High + Low	0.808	1.050	0.760	5.9
High	0.092	0.096	0.064	30.4
Low	0.716	0.964	0.696	2.8

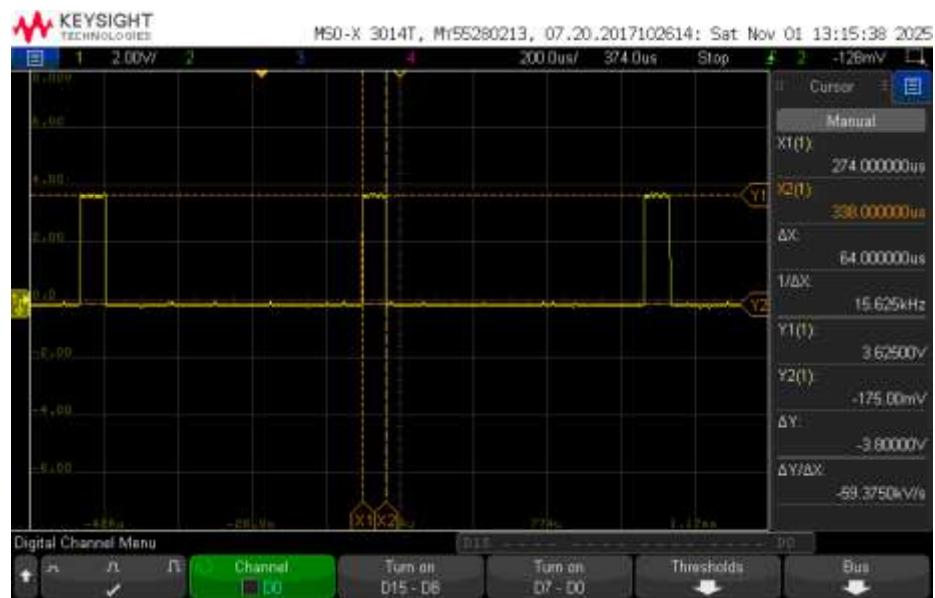
Low Brightness LED using Astable 555 Timer Circuit Measurements



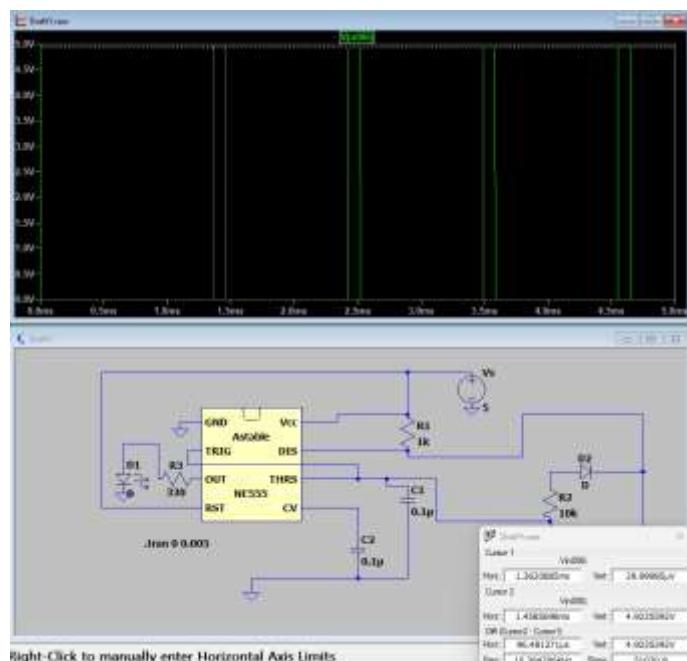
LED Dimmer Circuit using 555 Timer (Dim Light, Full Period)



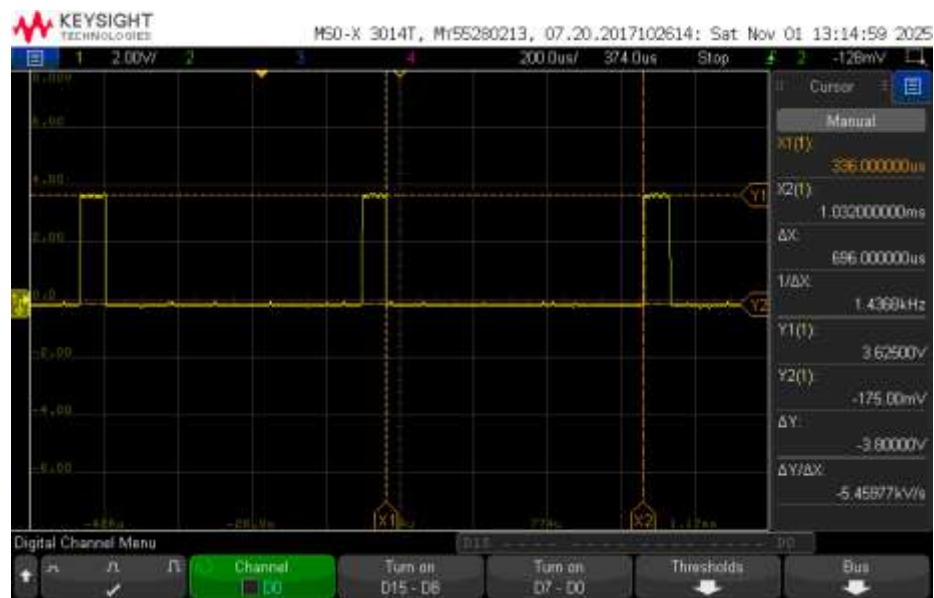
LTSpice LED Dimmer Circuit using 555 Timer (Dim Light, Full Period) Simulation



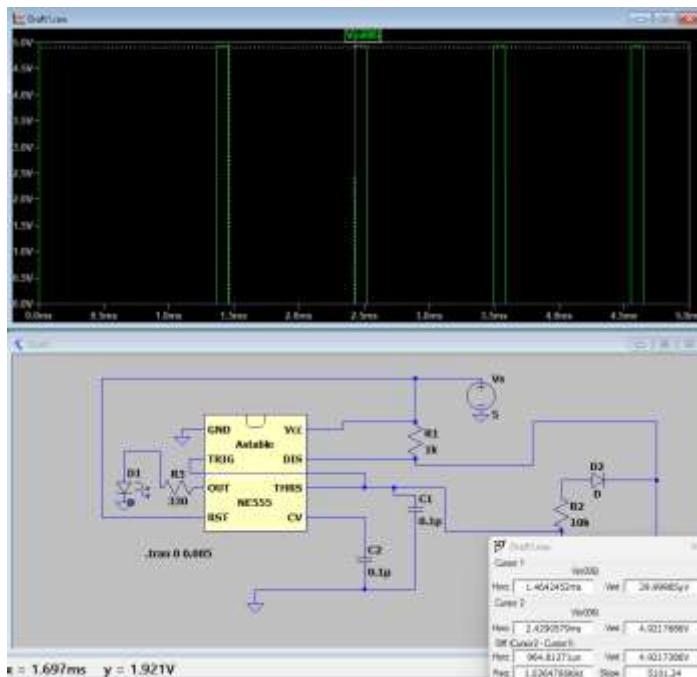
LED Dimmer Circuit using 555 Timer (Dim Light, High Voltage Period)



LTSpice LED Dimmer Circuit using 555 Timer (Dim Light, High Voltage Period) Simulation



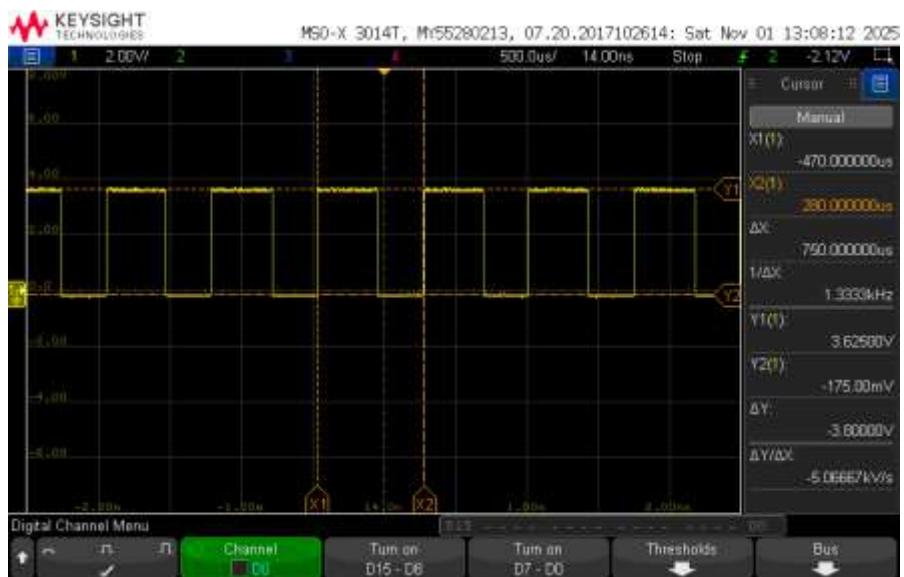
LED Dimmer Circuit using 555 Timer (Dim Light, Low Voltage Period)



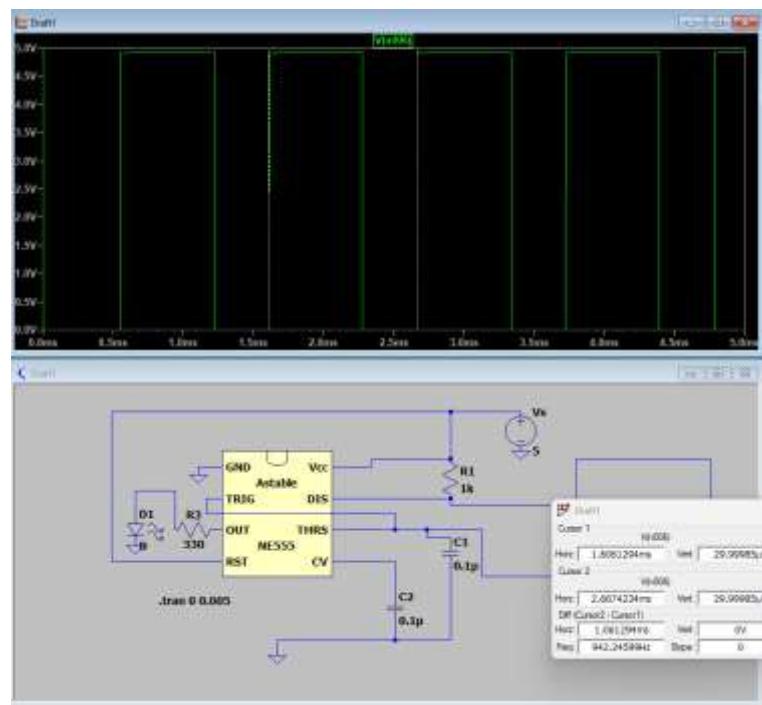
LTSpice LED Dimmer Circuit using 555 Timer (Dim Light, Low Voltage Period) Simulation

Voltage	Calculated Period (ms)	Simulated Period (ms)	Experimental Period (ms)	Percent Error (%)
High + Low	0.807	1.06	0.750	7.1
High	0.438	0.664	0.420	4.1
Low	0.369	0.391	0.310	16.0

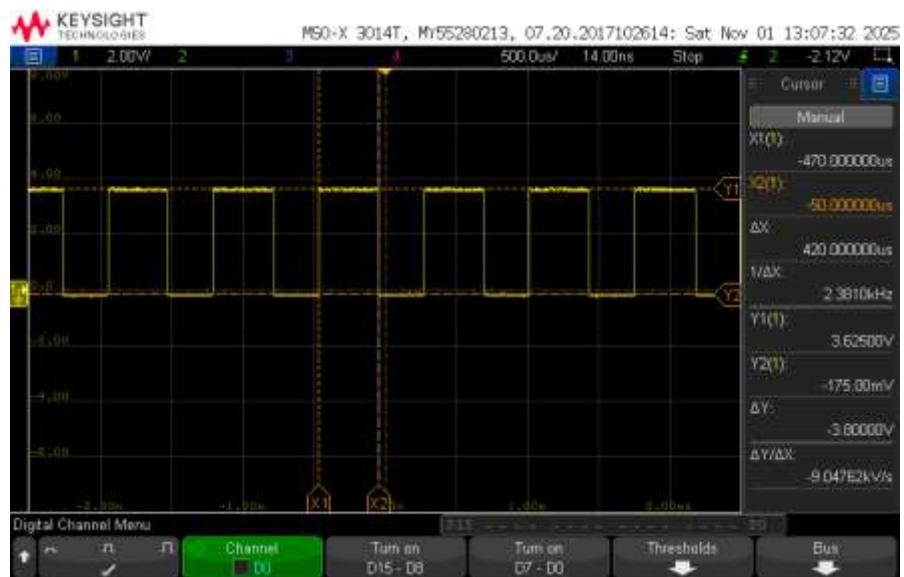
Medium Brightness LED using Astable 555 Timer Circuit Measurements



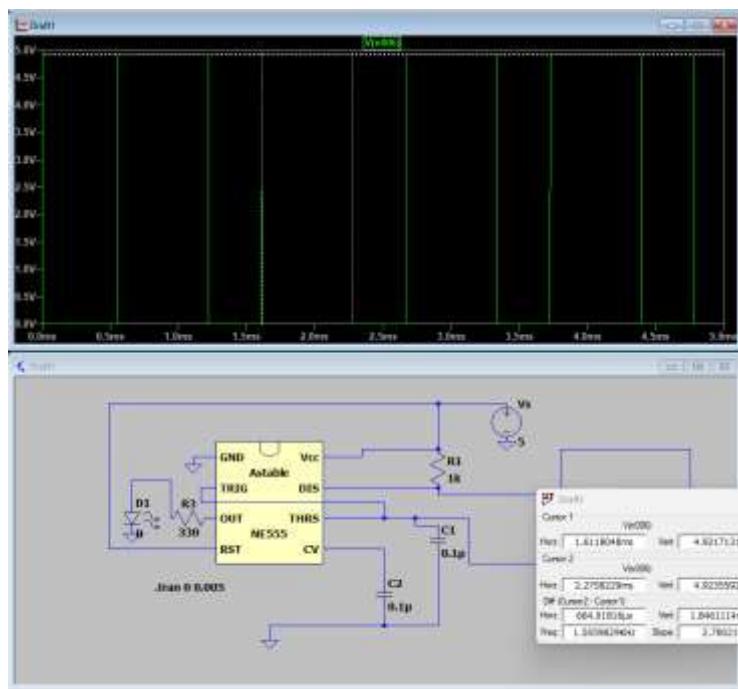
LED Dimmer Circuit using 555 Timer (Medium Light, Full Period)



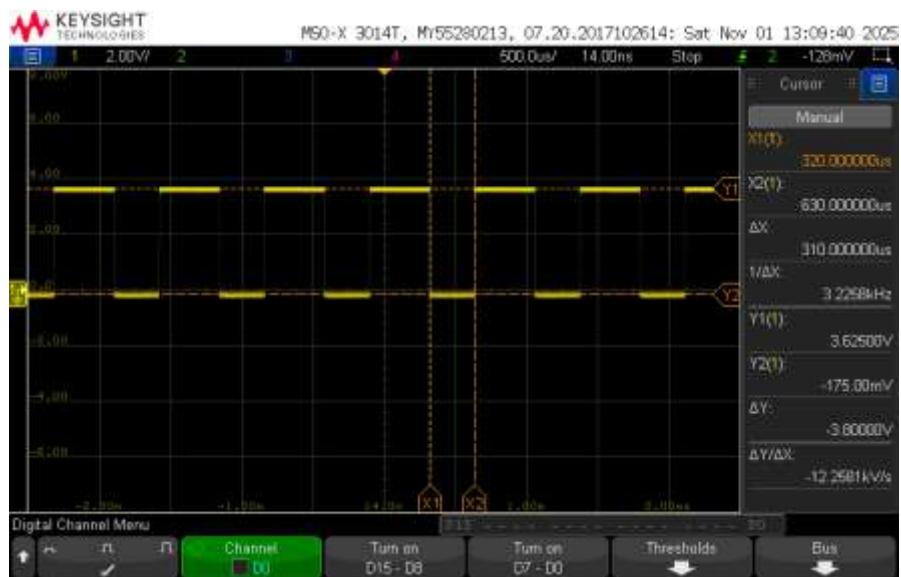
LTSpice LED Dimmer Circuit using 555 Timer (Medium Light, Full Period) Simulation



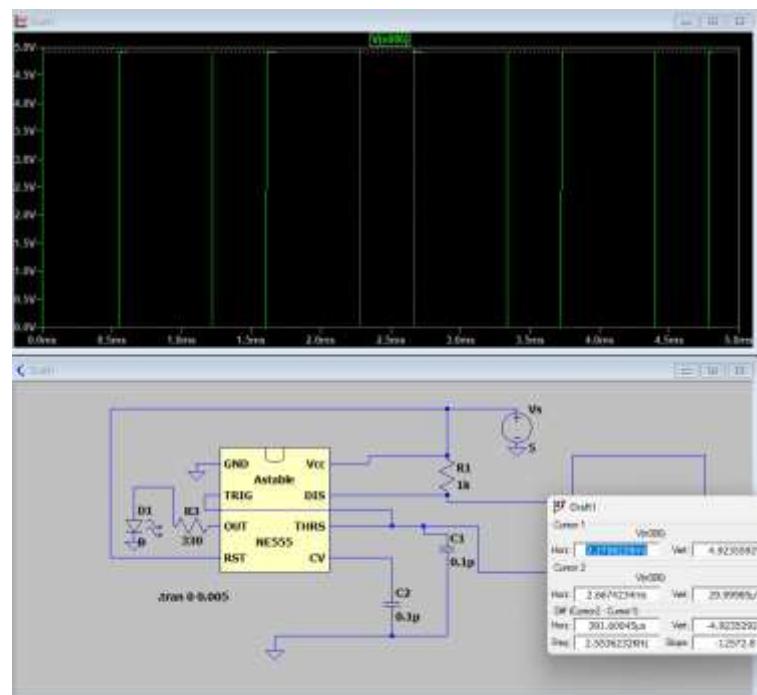
LED Dimmer Circuit using 555 Timer (Medium Light, High Voltage Period)



LTS spice LED Dimmer Circuit using 555 Timer (Medium Light, High Voltage Period) Simulation



LED Dimmer Circuit using 555 Timer (Medium Light, Low Voltage Period)



LTSpice LED Dimmer Circuit using 555 Timer (Medium Light, Low Voltage Period) Simulation