ELEC ENG – 2CJ4

Laboratory Experiments (Set 2)

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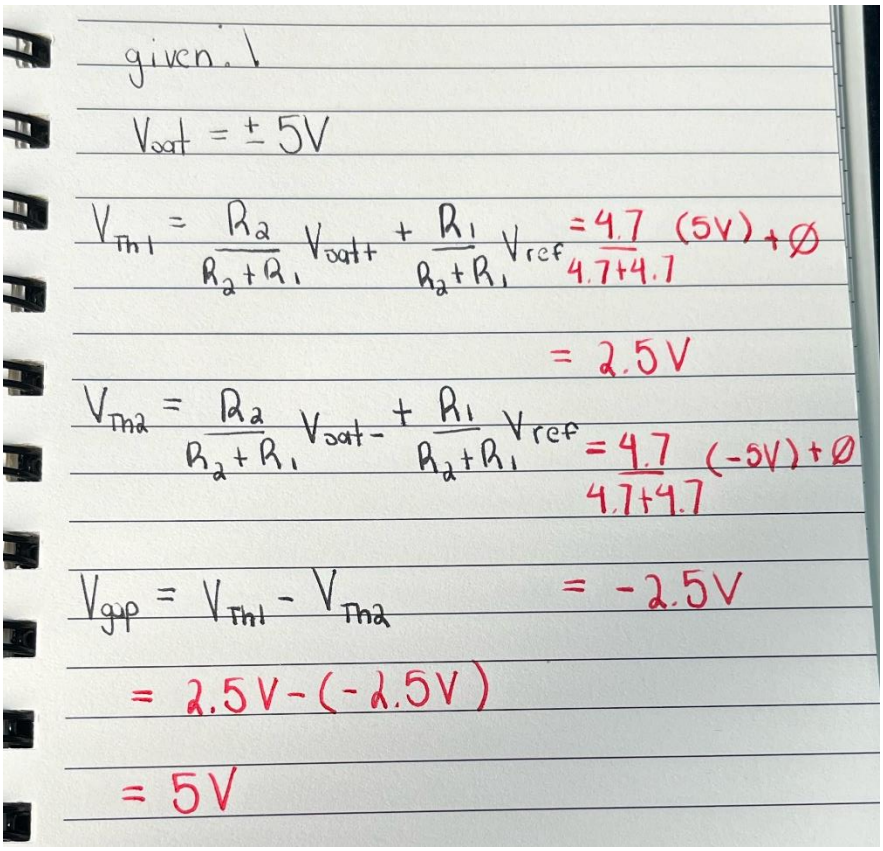
1. When $V_{in}(t)$ is increased or decreased such that $V_{th2} < V_{in}(t) < V_{th1}$, the output remains the same due to the Schmitt Trigger Circuit. The Schmitt Trigger Circuit takes in a noisy-sinusoidal circuit and converts it into a smooth square-wave function. The voltages that are defined as the threshold voltages, V_{th1} and V_{th2} respectively are the transition voltages that go from low to high, if we were to go below the V_{th2}, a lower output would be desired and the opposite for the V_{th1}. If the input voltage lies within the $V_{th2} < V_{in}(t) < V_{th1}$, the desirable output would be to remain within this threshold.

2.

(V_{ref}, R_1, R_2)	$V_{th1}\ (Theoretical)$	$V_{th2}\ (Theoretical)$	$V_{gap}\ (Theoretical)$
$(0V, 4.7k\Omega, 4.7k\Omega)$	2.5V	-2.5V	5V
$(0V, 22k\Omega, 4.7k\Omega)$	0.88V	-0.88V	1.76V
$(2V, 4.7k\Omega, 4.7k\Omega)$	3.5V	-1.5V	5V
$(2V, 22k\Omega, 4.7k\Omega)$	2.53V	0.77V	1.76V

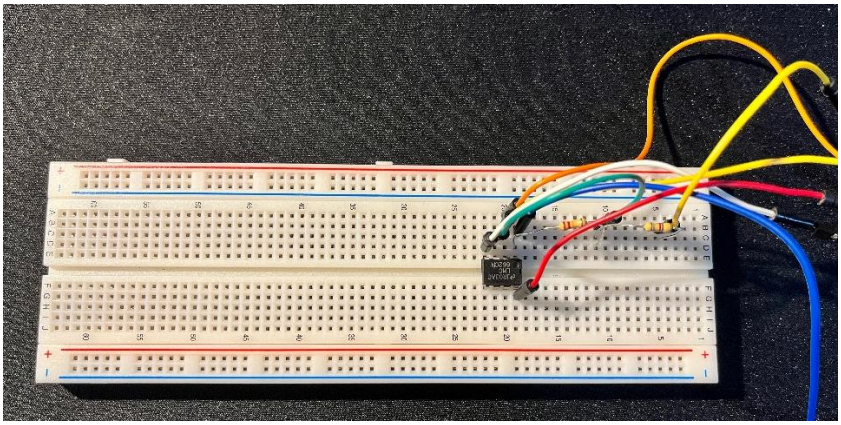
Sample Calculation (1st Row):



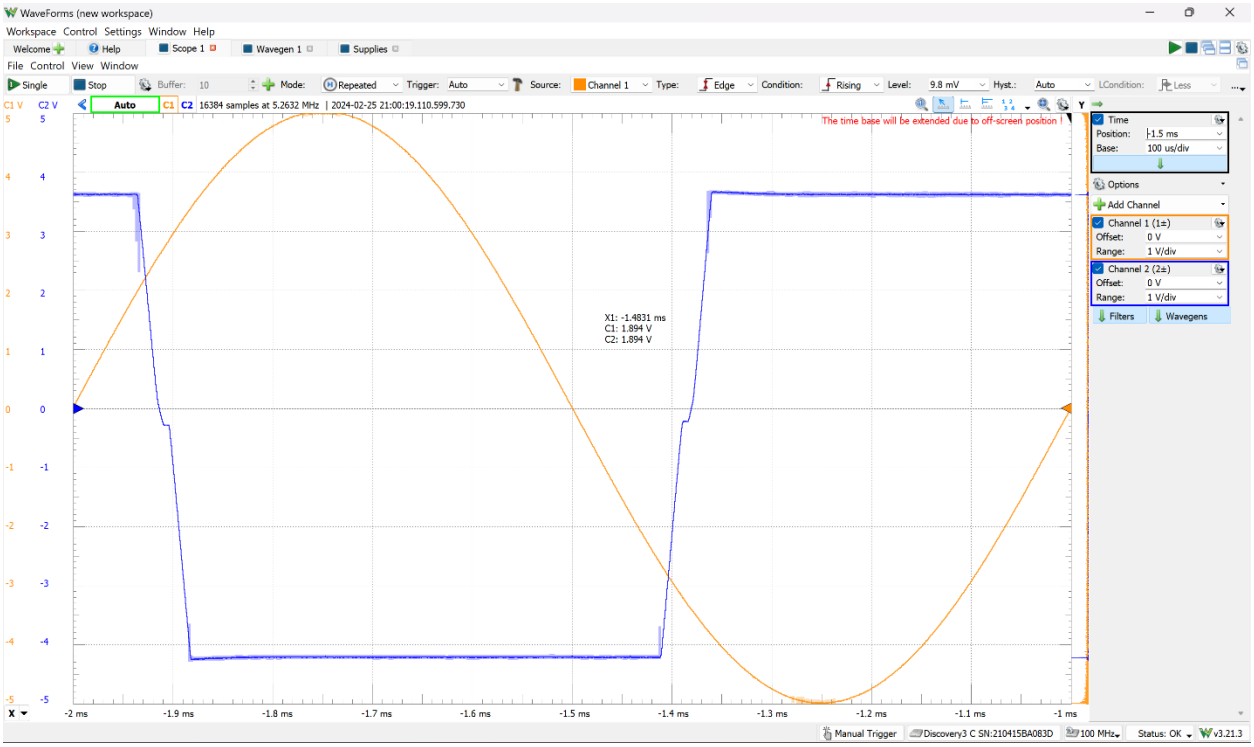
3.

(V_{ref}, R_1, R_2)	V_{th1} $(Measured)$	V_{th2} $(Measured)$	V_{gap} $(Measured)$
$(0V, 4.7k\Omega, 4.7k\Omega)$	2.232 V	-2.812 V	5.044 V
$(0V, 22k\Omega, 4.7k\Omega)$	1.101 V	-1.01 V	2.111 V
$(2V, 4.7k\Omega, 4.7k\Omega)$	3.069 V	-2.151 V	5.22 V
$(2V, 22k\Omega, 4.7k\Omega)$	2.739 V	0.5213 V	2.2177 V

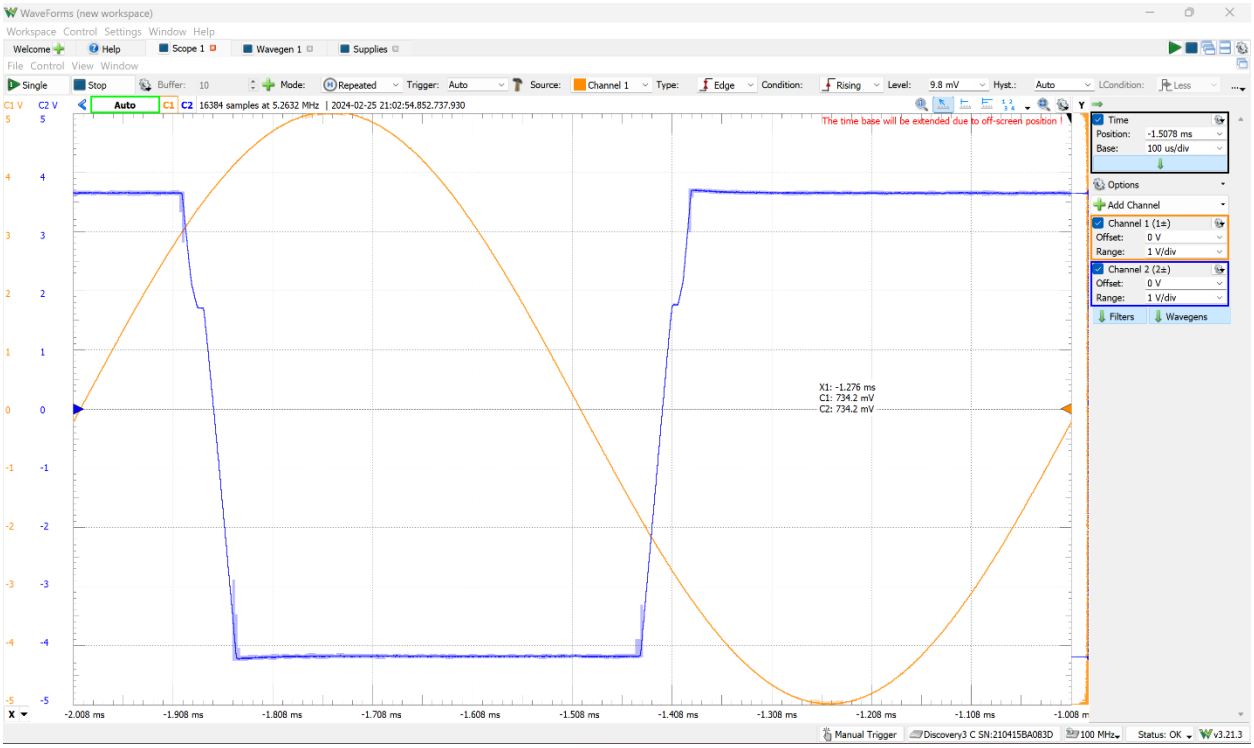
Circuit Design:



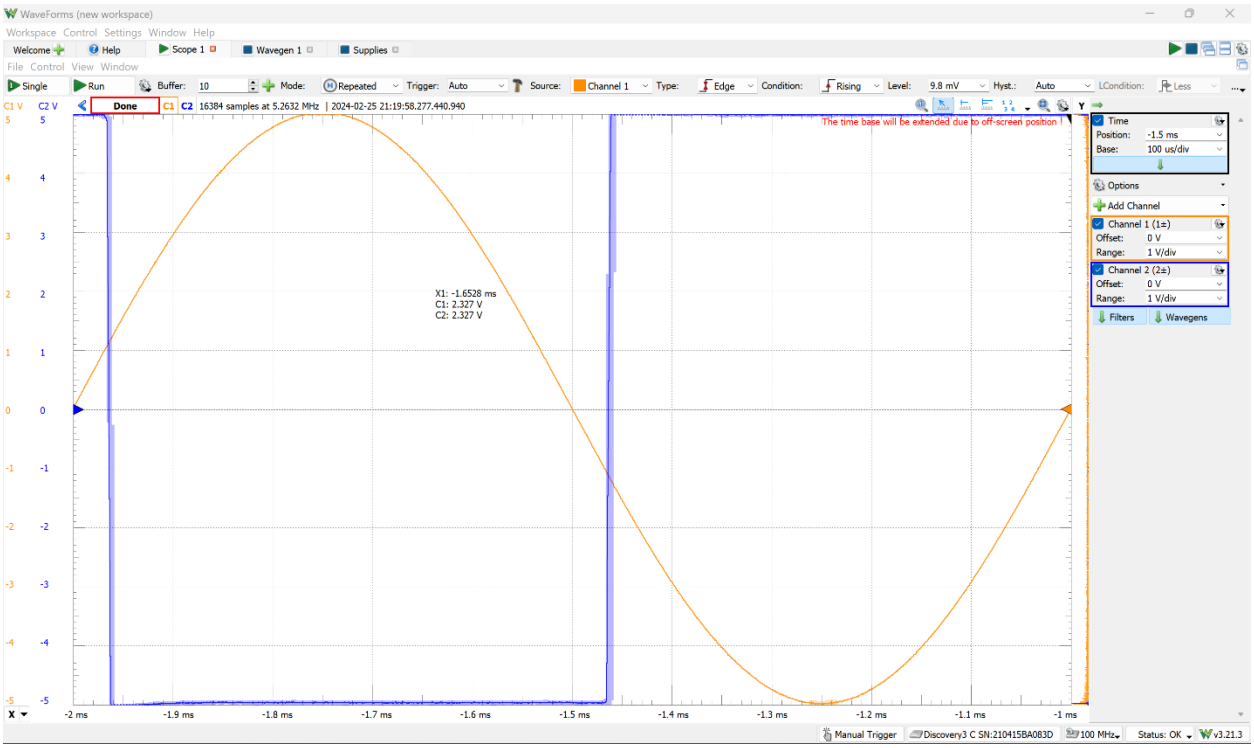
$(0V, 4.7k\Omega, 4.7k\Omega)$:



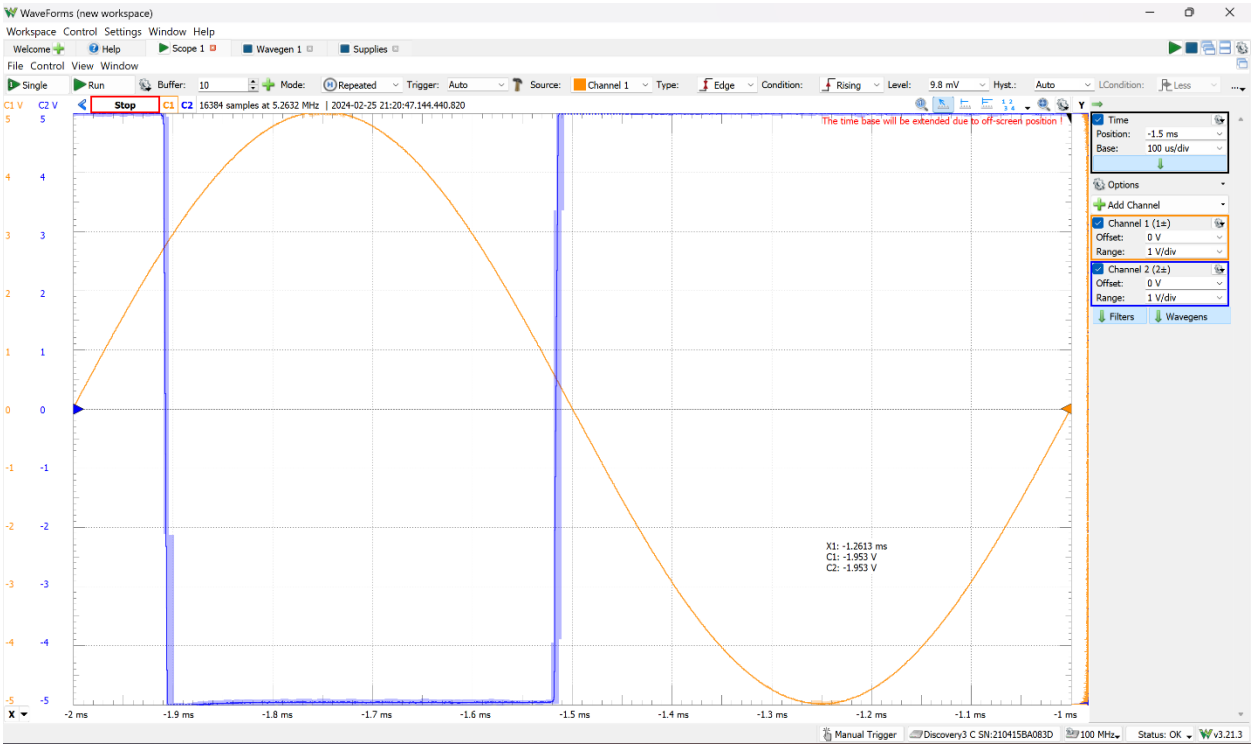
$(2V, 4.7k\Omega, 4.7k\Omega)$:



$(0V, 22k\Omega, 4.7k\Omega)$:



$(2V, 22k\Omega, 4.7k\Omega)$:



4.

(V_{ref}, R_1, R_2)	V_{th1} (% $Difference$)	V_{th2} (% $Difference$)	V_{gap} (% $Difference$)
$(0V, 4.7k\Omega, 4.7k\Omega)$	11.32%	11.747%	0.876%
$(0V, 22k\Omega, 4.7k\Omega)$	22.312%	13.756%	18.134%
$(2V, 4.7k\Omega, 4.7k\Omega)$	3.609%	35.662%	4.305%
$(2V, 22k\Omega, 4.7k\Omega)$	7.933%	38.519%	23.013%

5. V_{gap} is not affected by the change of V_{ref} from zero to a non-zero value. In the theoretical calculations, changing V_{ref} whilst keeping all else the same does not have an impact in V_{gap}. The change in V_{ref} simply results in a shift either upwards or downwards by the value of the reference voltage.