**C8 – Timers / Counters and Pulse Width Modulation**

3.1 Producing an Audio Frequency Square Wave

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| 260.417Hz ≈ 262Hz = Middle C |
| 1.581V ≈ ½ x 3.3V |

3.2 Generate a Tone Scale

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| Performs chromatic scale ascending and descending as expected. |
| The diode is to control the charge in the capacitor. When the trigger pin is high the capacitor charges, then when it goes low the diode prevents the change stored in the capacitor from going through the trigger pin to ground and instead goes through the rest of the circuit. |

3.3 Play a Tune

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| Melody plays as expected when function are replaced with my written tone functions. |
| One using the CD4066 chip, the notes the ease in and the die away rather then the hard on off sound in the previous circuit. As seen in the waveform below. |
| I used a slightly longer pulse time of 20ms. Having too short of a trigger length results in the capacitor not being charged enough and the note only sounding for a very short amount of time which is not ideal. |

3.4 Volume Control with PWM

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| When connecting PD7 to the trigger input on the circuit it controls the volume of the tone as expected. |
| When a couter i is implemented to increment each time a note is played and therefore increase the volume, once it gets to the maximum value of 255 it then overflows and go back down to 0. This is because i is a uint8\_t which means it only takes positive values of an 8 bit length so after 255 it goes back to 0, ignoring the 9th bit which would be set to 1 for 256. |

4 Stereo Panning

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| Since I already had both PWM channels A and B set up for init\_volume, I implemented the new function pan(uint8\_t l, uint8\_t r). Where the left and right channel can be set at volumes independently. To get this to a single value I put in my main loop pan(i, 255-i); |
| As we can see the high pulse of channel A is equal to the low pulse of channel B, as expected for panning. |