

### **Input Buffer Stage**

R2 and R3 form a non-inverting amplifier circuit that amplifies the guitar level (100-400 mV) to acceptable ADC level (5 V). This means the circuit gain has to be at most  $5V/0.1V = 50$  and at least  $5V/0.4V = 12.5$ .

- $A = 1 + \frac{R2}{R3} = 1 + \frac{100k}{4.7k} = 22.277$

R2 and C8 form a low pass filter that allows all frequencies below 4823 Hz to pass. Additionally, R3 and C9 form a high pass filter that allows all frequencies above 34 Hz to pass. C7, R5 and R6 form another high pass filter that eliminates the DC component from the signal. These filters cut out unnecessary noise and frequencies that are harsh when amplified.

- $f = 1/2\pi RC$

R4 essentially becomes the input impedance of the signal chain, which is typically 1M Ohms for guitar pedals.

### **Output Buffer**

2 PWM pins are used in order to double the bitrate of the output signal. If only one PWM signal is outputted by the ATmega, the output amplifier defaults to being a buffer.

Resistors R9, R10, capacitors C14, and C11 all form a 3rd order Sallen & Key low pass filter with a cutoff frequency at 5131 Hz.

- $f = 1/(2\pi * \sqrt{R_9 R_{10} C_{14} C_{11}})$

Capacitor C12 eliminates any DC offset before outputting the final, processed signal.