AUDIO ON FPGA

OVERLOOK OF SYSTEM

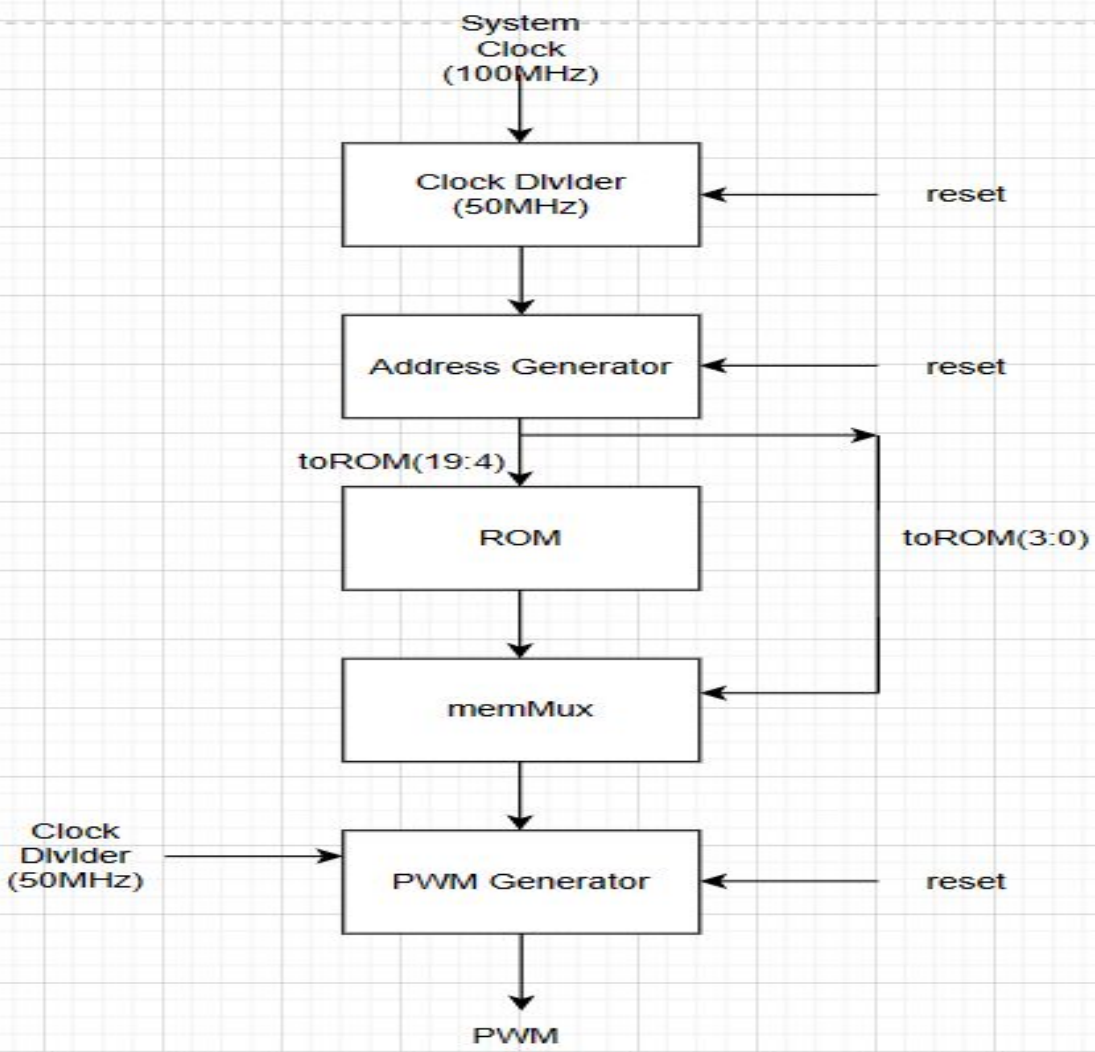
- The system works to convert the audio in digital form to analog form.
- The audio is a .wav file hence the .wav file format must be taken into consideration when doing the analog to digital conversion.
- .wav files have 16bit precision meaning it has 65536 quantisation levels.
- The nexys A7 uses PWM as a way to output audio .

- In converting the binary to PWM, we use a counter to count from 0 to 65535 to represent the quantisation levels of the .wav file for each 16bit sample of the binary data.

- Whenever each count is less than each 16bit sample the PWM output signal is set high. This means that particular sample was quantised at that particular level.

- This serves as the way of modulating the duty cycle of the PWM to output the audio signal.

- The clock speed of the counter should be 65536 * 700 = 45.875200MHz as we desire the audio to be played at 700Hz which is within the audible range.


System Clock (100MHz)
Clock Divider (50MHz)
reset
Address Generator
reset
toROM(19:4)
ROM
toROM(3:0)
memMux
Clock Divider (50MHz)
PWM Generator
reset
PWM

CLOCK DIVIDER

$$\frac{100 \times (10)^6 Hz}{2^x} = 45875200 Hz$$

$$2^x = \frac{100 \times (10)^6}{45875200}$$

$$2^x = 2.1798$$

$$x = \frac{log 2.1798}{log 2}$$

$$x = 1.1242$$

Therefore a 2 bit counter is used for the clock divider

- Clock divider is to convert the 100MHz clock to 45.875200MHz.

- From the calculations it would take a 2 bit counter to be able to generate about 45.875200MHz clock from the 100MHz clock.

- The exact frequency that would be generated is 50MHz.

Address Generator

- A counter would be used for the address generator.
- The address generator is also used to generate select values for the memory multiplexer.
- The counter counts up to 1048575(20 bits) to address the memory which has a depth of 65536 and width of 256 bits.
- The address would consist of bits 19 downto 4 and the multiplexer select line would be 3 downto 0 of the 20 bit output of the address generator

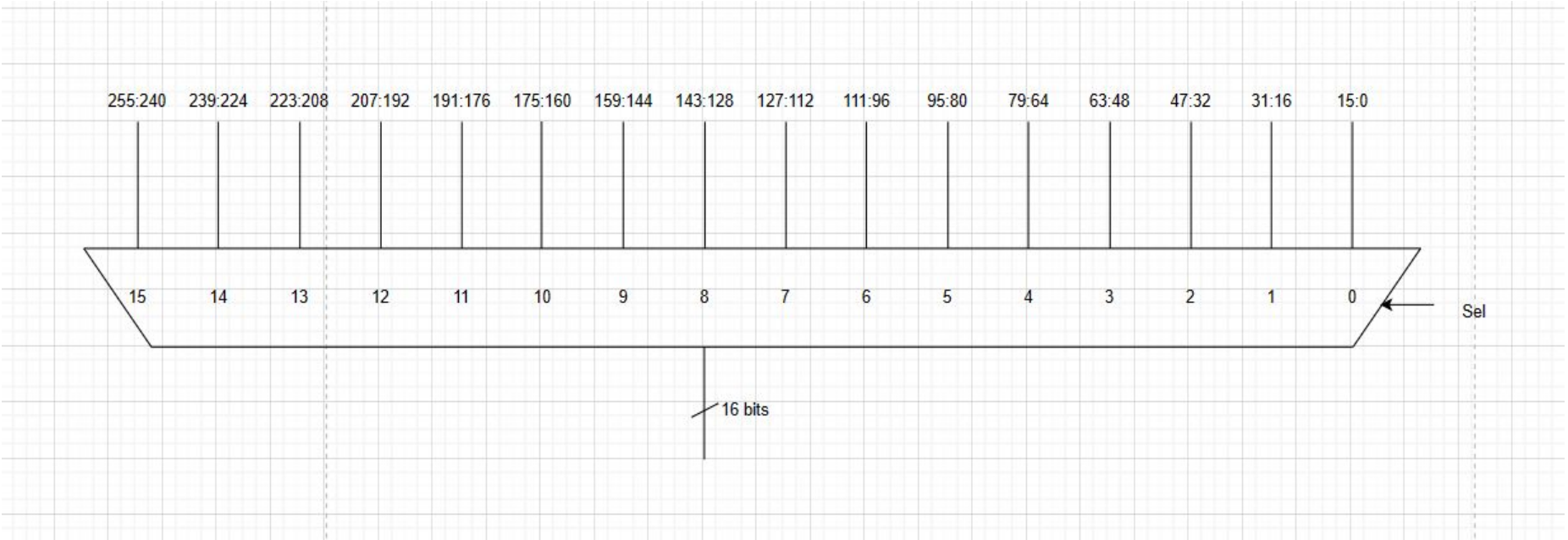
ROM

- The ROM has a depth of 65536 and each address contains 256 bits.

- This memory space contains the audio samples in the binary format.

memMux

- This component is a multiplexer for the memory.



PWM GENERATION