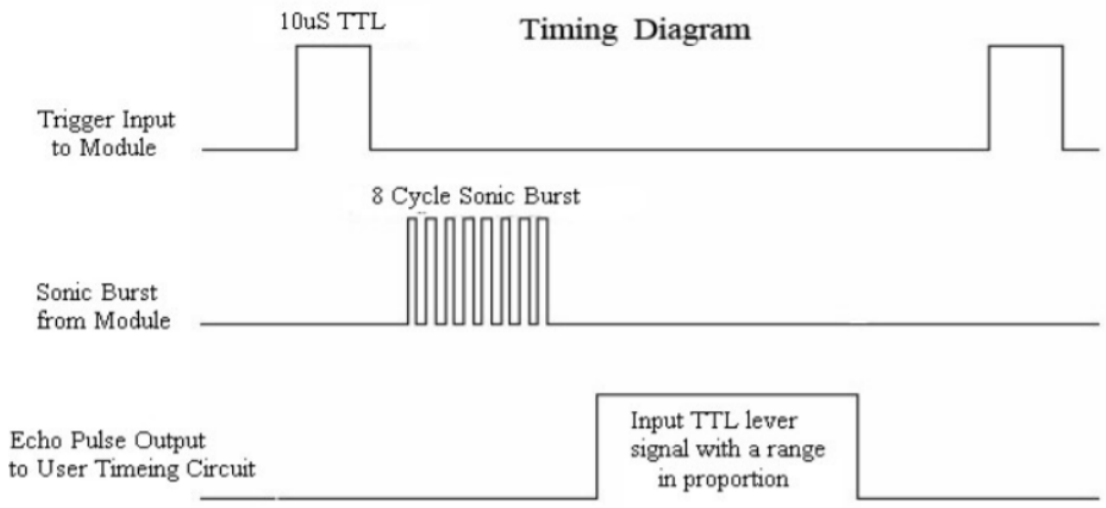
Exercise 6

Exercise 6.1 – Ultrasonic distance sensor

The HC-SR04 ultrasonic distance sensor can be used to measure distances of approximately 2-400 cm. It has four pins. Two of them (Vcc and Gnd) are for power, while the other two (Trig and Echo) are for signals.

Pin Symbol	**Pin Function Description**
Vcc	5V power supply
Trig	Trigger input pin
Echo	Receiver output pin
Gnd	Gnd

To activate the sensor a HIGH pulse of at least 10µs must be put on Trig. Once the trigger pulse goes back to LOW 8 sonic pulses at 40 kHz are transmitted from the sensor and the Echo pin goes to HIGH and stays like this until the reflection of the 8 sonic pulses is detected. To determine the distance the time that the Echo pin is HIGH must be measured.



Be careful about sending out multiple pulses rapidly as “old” pulses might interfere with “new” measurements.

Sound is assumed to travel at a speed of 343 meters per second. Remembering that the sound travels both forwards and backwards in the measured time the distance should be halved. By converting the speed of sound to µs/cm and halving the distance the following equation is obtained

$$distance = velocity * time$$

$$distance[cm] = \frac{time[\mu s]}{58\mu s/cm}$$

- Write a function that activates the distance.
- Start a timer to measure the distance.
- Set up an interrupt that stores the value of the timer when the Echo pin changes state.
- Display the difference between timer values converted to cm (Remember that the timer will reset once it reaches its maximum. In the case where value1>value2, this must be accounted for).