



Automotive Rear Sonar

Submitted by: R. Hugo Vieira Neto and Francisco Eugenio Mauro

Abstract

The Automotive Rear Sonar is intended for automotive use. It is simple, effective, and inexpensive. Designed with a ZiLOG Z8 OTP microcontroller, this device measures the distance between the vehicle and any obstacle when in reverse gear. The driver is informed when a collision is about to occur.

The sonar utilizes a pair of ultrasonic transducers to send and receive 40-kHz wave bursts. The goal is to measure the time of flight of the ultrasonic burst if an echo occurs.

A Z86E08 microcontroller running at 8 MHz acts as the system control block. Some of the Z86E08s key features are:

- Short instruction execution times (generation of the 40-kHz ultrasonic signal by software)
- Onboard analog comparators (making ultrasonic detection simple and inexpensive)
- Onboard counter/timers with prescalers (making ultrasonic wave time-of-flight easy to measure)

Ultrasonic waves are strongly attenuated along their propagation in the air. That makes their detection quite difficult as distance increases. In order to achieve feasible detection, the transmitter is given as much power as possible, and the receiver circuit is furnished enough sensitivity to detect small-echo signals.

The transmitter driver is responsible for the excitation of the ultrasonic transmitter. For maximum output power, an H-bridge amplifier configuration is used to drive the transducer that is controlled by a pair of I/O pins of the Z8 port P2.

One of the Z8's onboard analog comparators implements the receiver detector. To adequately bias the comparator inputs, a resistive network is connected to the Z8 port P3, which features a sensitivity adjustment for the output amplitude of the receiver transducer.

Another transmitter driver circuit is implemented on another pair of I/O pins on port P2. A receiver detector is implemented using the other available analog comparator input on port P3. The resulting pair of ultrasonic transmitters and receivers is mechanically mounted on the left and right sides of the car's rear bumper for more safety.



A low-power voltage regulator IC supplies the 5 volts required by the Z8 from the vehicle's 12-volt battery. The car's reverse gear light circuit can also supply power, so that the sonar would be turned on when in reverse gear only.

User feedback is performed visually by means of an LED and/or audibly by a piezoelectric buzzer.

Figure 1. Automotive Rear Sonar Block Diagram

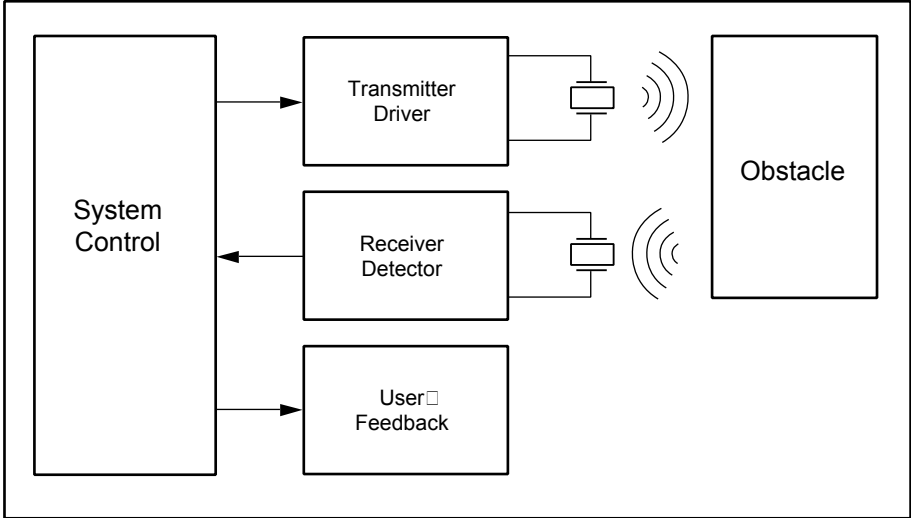




Figure 2. Automotive Rear Sonar Schematic Diagram

