

Lab 8 - Bus based data transfer using Tri-State Buffers

*Digital Systems and Microcontrollers,
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Objective

To get familiar with the working of a tri state buffer and understand data flow control using a tristate buffer

Theory

The tri-state buffer (Fig 1) functions just as a regular digital buffer where the value at its input is propagated to its output. But it has an additional capability that allows us to configure its output to a Hi-Z (high impedance) state.

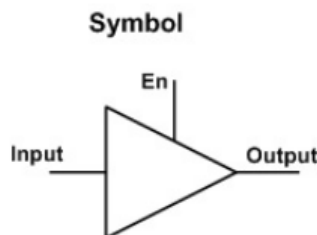


Fig. 1 Tri State Buffer

When the output of the buffer is in Hi-Z state it is basically disconnected (isolated) from the rest of the electric circuit. This makes it very useful when connecting multiple devices on a single bus, as its isolation prevents the occurrence of a short circuit event

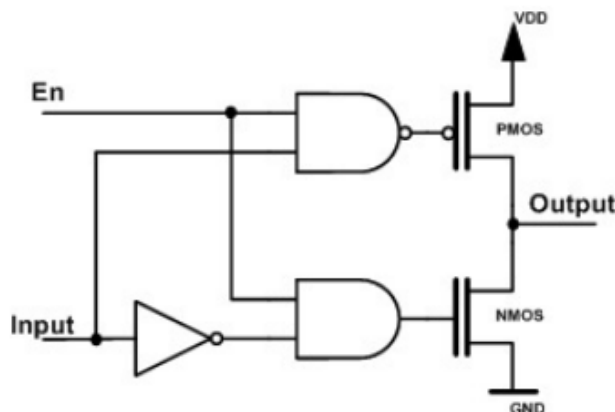


Fig. 2 Circuit of a Tri State Buffer

In Fig. 3 an example is given where five devices are connected to a bus using tri-state buffers. At any single moment, only one of them should drive the line and all others should be disabled (Hi-Z state). A device that sets its output to Hi-Z can read the value driven on the bus by other devices. In other words, only one device can write to the line, but all of the devices can read it.

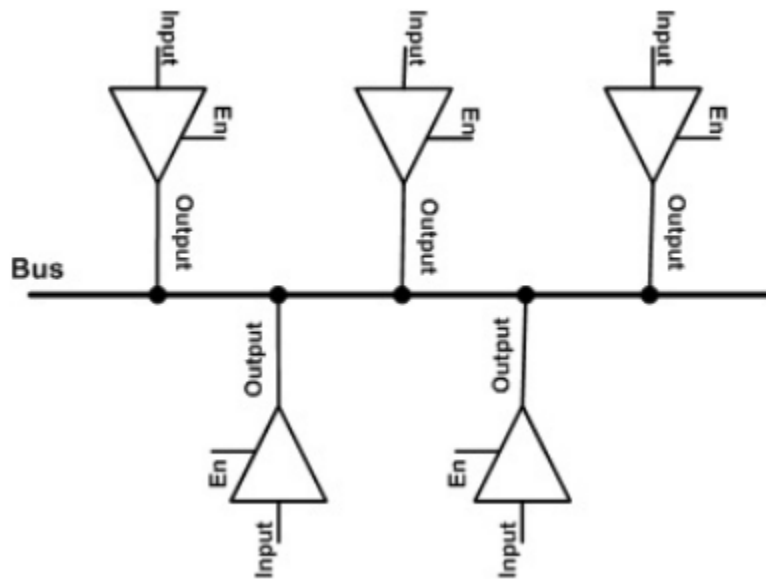


Fig. 3 Buffers connected to a data bus

In the experiment, you will verify the working of a tristate buffer and similar to the example given, use the tri state buffers to transfer contents of one shift register (74HC595 IC) to another shift register. Note that the output of the shift register is parallel (you will be using only the first 4 bits) while the input is serial. Therefore, you would be connecting the outputs to a single data bus using tristate buffers and reading the input to the second register from that bus.

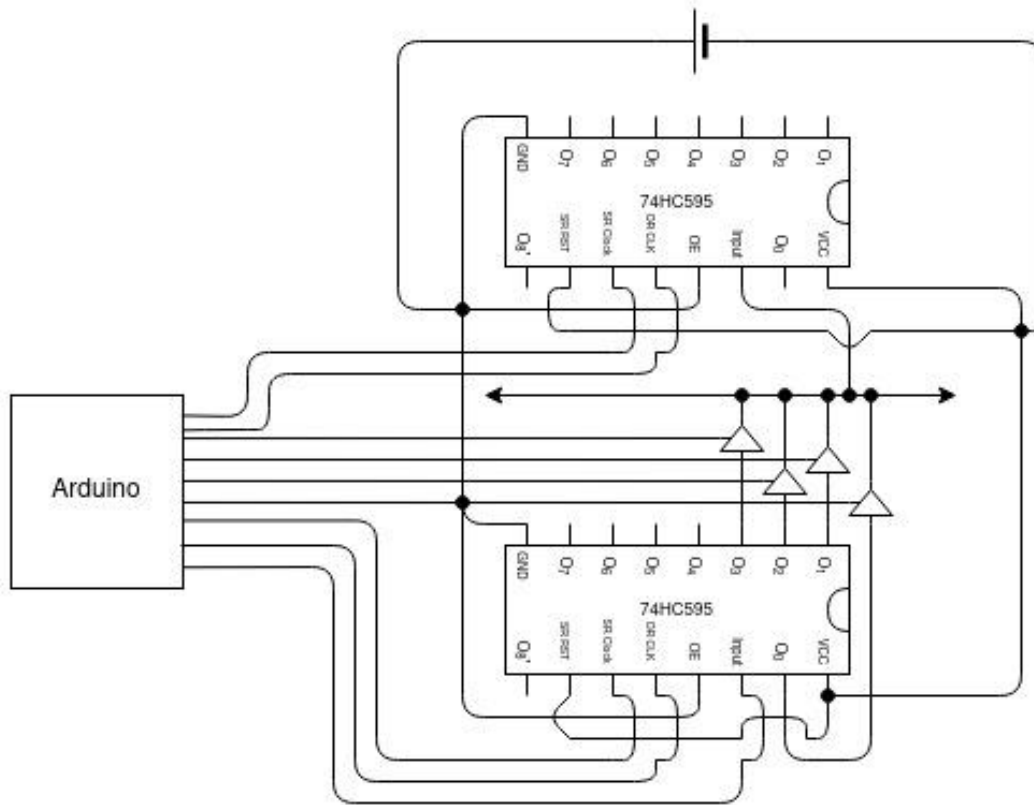


Fig. 4 Circuit Diagram

Experiment

Part A: Working of the Tri state Buffer

- You have been given an implementation of a tri state buffer at this [link](#).
- The input to the buffer and the enable signal have to be given to the circuit using arduino.
- Verify the working of the tri state buffer and create the truth table.

Part B: Data flow using Tri state Buffers

- Assemble the circuit given in Fig. 4.
- You can find a circuit with four tri state buffers [here](#).
- Take an input number (0-15) and send it to the first register (Recall Lab 6).
- Write code to enable the tristate buffers in order and correspondingly apply clock pulses to the second shift register such that the content from the first register is transferred.

References

Working of Shift registers: https://www.electronics-tutorials.ws/sequential/seq_5.html