

Digital Logic Design (EL-227) LABORATORY MANUAL Spring-2021



LAB 07 Binary Decoder

STUDENT NAME

ROLL NO

SEC

INSTRUCTOR SIGNATURE& DATE

MARKS AWARDED: /

NATIONAL UNIVERSITY OF COMPUTER AND EMERGING SCIENCES (NUCES), KARACHI
Date: 05/04/2021

Lab Session 07: Binary Decoder

OBJECTIVES:

After completing this lab, you would be able to know

- To study the basic operation and design of the decoder circuits
- Explain the working principle of 3-8 line decoder & BCD to Seven Segment decoder
- Understand the usage of Seven Segment Display
- To learn the concept of enabling a signal (active-low and active-high enable)

APPARATUS:

- Logics Trainer, Logics works

COMPONENTS:

- 74LS138 (3-8 line decoder)
- 74LS47 (BCD to Seven Segment Decoder)
- 74LS08, 74LS32, 74LS04, 74LS00, 74LS02

Introduction:

Decoder is a multiple-input, multiple-output logic circuit that converts coded inputs into coded output coded outputs. The basic function of decoder is to detect the presence of a specified combination of bits (code) at its input and indicate the presence of that code by a specified output. Various kinds of decoding include n-to- 2^n decoding & binary-coded decimal decoding. Decoder has Enable inputs which must be on for the decoder to function. A decoder is a combinational circuit that decodes the encoded inputs. A binary decoder has n inputs and a maximum of 2^n outputs. An n-bit binary number provides 2^n minterms or maxterms. The decoder that produces 2^n minterms as its outputs is said to be a decoder with active high outputs, whereas, the decoder that produces 2^n maxterms as its outputs is said to be a decoder with active low outputs. Let us take $n=2$ as an example, so that we obtain the 2-to-4 line decoder with active high outputs. Figure 7-1 shows the block diagram of 2x4 decoder.

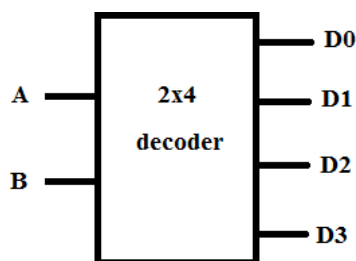


Figure 1 2x4 decoder Block Diagram

Truth Table:

Inputs		Outputs			
A	B	D0	D1	D2	D3
0	0	1	0	0	0
0	1	0	1	0	0
1	0	0	0	1	0
1	1	0	0	0	1

Boolean Expressions of Outputs:

D0: $\bar{A}\bar{B}$

D1: $\bar{A}B$

D2: $A\bar{B}$

D3: AB

The Boolean expressions show that four outputs of 2x4 decoder show four minterms of two binary variables **A** and **B**.

Circuit diagram for 2x4 decoder with active high outputs:

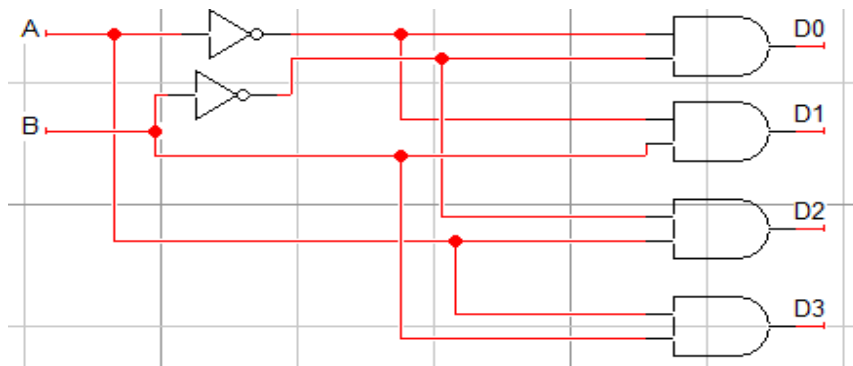


Figure 2 2x4 decoder schematic

Circuit diagram for 2x4 decoder with active high outputs and active high enable:

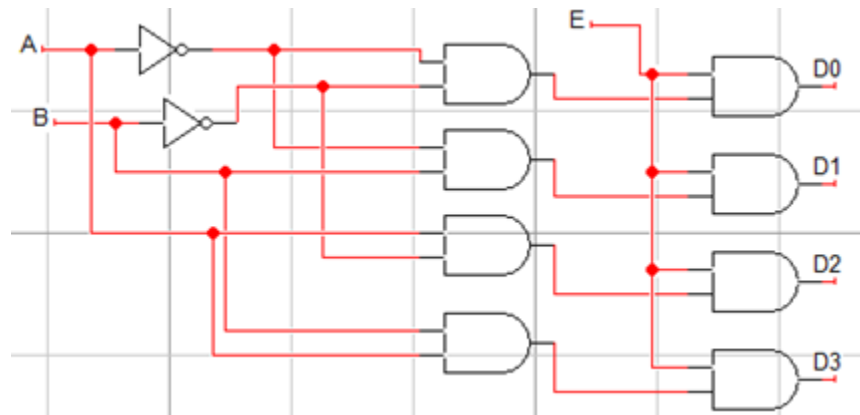


Figure 3 2x4 decoder schematic with enabling

Implementation of 3-8 line Decoder using IC 74LS138

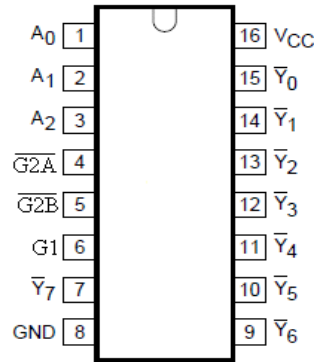


Fig 4. Pin Configuration

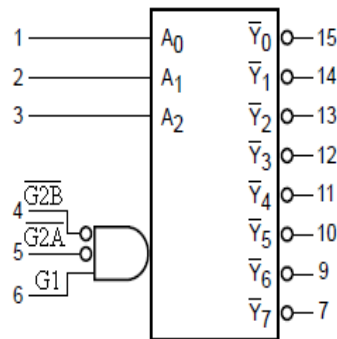


Fig 5 . Logic Symbol

This decoder decodes one of eight lines depending on the three binary select inputs and three enable pins. It is an octal decoder capable of decoding eight possible three-bit combinations to eight separate active-Low outputs.

A ₀ –A ₂	InputBits
G2A',G2B'	Enable (ActiveLOW)Inputs
G1	Enable (ActiveHIGH)Inputs
Y ₀ '-Y ₇ '	Active LOWOutputs

Implementation of BCD to Seven Segment Decoder using IC 74LS47

The BCD to Seven Segment Decoder accepts BCD code on its input and provides outputs to derive Seven-segment display devices to produce a decimal read-out by turning on the appropriate LED segments. If the Seven Segment display is a common-anode display that is an active Low (Low-enable) device because it takes 0 to turn on a segment, the decoder IC to be used must also have active Low outputs. IC 74LS47 has active low outputs therefore it will require a common-anode display device for compatibility.

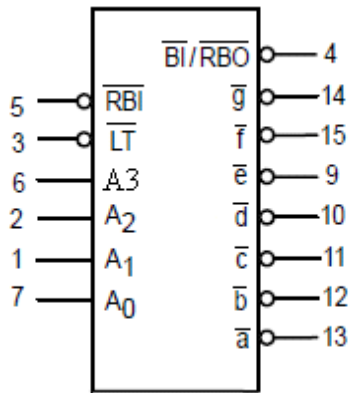


Fig 6. Pin Configuration

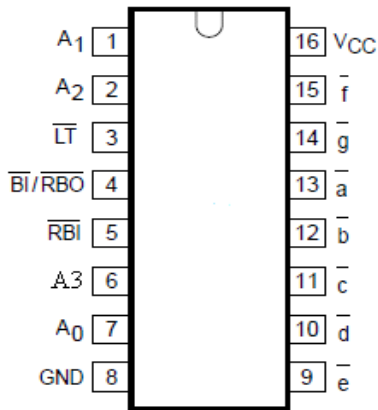


Fig 7. Logic Symbol

A0–A3 BCD Inputs

RBI' Ripple Blanking Input (Active LOW)

LT' Lamp Test Input (Active LOW)

BI'/RBO' Blanking Input or Ripple Blanking Output (Active LOW)

a'–g' Active LOW Outputs

Common Anode Display

Active low inputs

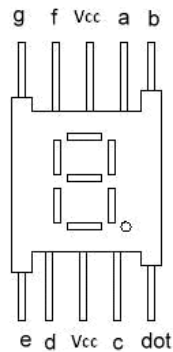


Fig 8. Pin Configuration

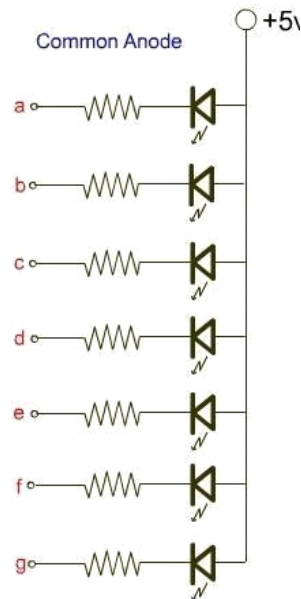


Fig 9. Logic Symbol

Decoders are used to analyze data streams for a certain data code and give an output if the data is present like an address to a peripheral unit that needs service.

Application of Decoder

1. These can be used in computer programs. Simple tasks like writing out documents or sending emails would use these kinds of things.
2. Decoding is necessary in applications such as data multiplexing, 7 segment display and memory address decoding.
3. microprocessor memory system
4. microprocessor input-output system
5. memory chip
6. microprocessor instruction chip & lots of other application

LAB TASK#1:

Design and implement a 2-to-4 line decoder with active low outputs along with active low enable input E. When E is low, the decoder will operate normally, when E is high, all outputs should be high regardless of the inputs.

- a) Write truth table

Lab Task #3:

Implementation of BCD to Seven Segment Decoder using IC 74LS47 Observations:

BCD to Seven Segment Decoder

[illegible]