

## Practical No.11: Build and test the functionality of 1:4/1:8 Demultiplexer.

### I Practical Significance

A demultiplexer (or demux) is an electronic circuit or device which has single input,  $n$  outputs and  $m$  number select lines. The input line is connected to any one output line depending upon the select lines input logic. An electronic demultiplexer can be considered as a single-input, multiple-output switch. Demultiplexers are mainly used in Boolean function generators and decoder circuits.

### II Industry/Employer Expected Outcome(s)

Students will be able to test the functionality of the digital circuits/system.

### III Course Level Learning Outcome(s)

Develop combinational logic circuits for given applications.

### IV Laboratory Learning Outcome(s):

1. Build/Test function of DEMUX Digital IC

### V Relevant Affective Domain related outcome(s)

Significance of select lines to connect input data line to selected one output from many outputs.

Handle the component and equipment carefully.

Follow all safety precaution

### VI Relevant Theoretical Background

Demultiplexer has only one input and " $n$ " number of outputs along with " $m$ " number of select inputs. A demultiplexer performs the reverse operation of multiplexer i.e. it receives one input and distributes it over several outputs. At a time only one output line is selected by the select lines and the input is transmitted to the selected output line. Hence demultiplexer is equivalent to a single pole multiple way switch as shown in figure. The enable input will enable the demultiplexer. The relation between the  $n$  output lines and  $m$  select lines is as given below.

$$n=2^m$$

The demultiplexer performs opposite process to a multiplexing process it performs "one to many" operation. It has only one input ( $D$ ) and  $n$  number of outputs ( $Y_0, Y_1, Y_2, \dots, Y_{n-1}$ ) as shown in the figure given below. Demultiplexer can also be used as a decoder e.g. Binary to Decimal Decoder. Data input given is  $I$ , strobe/enable pin issued for enabling DEMUX



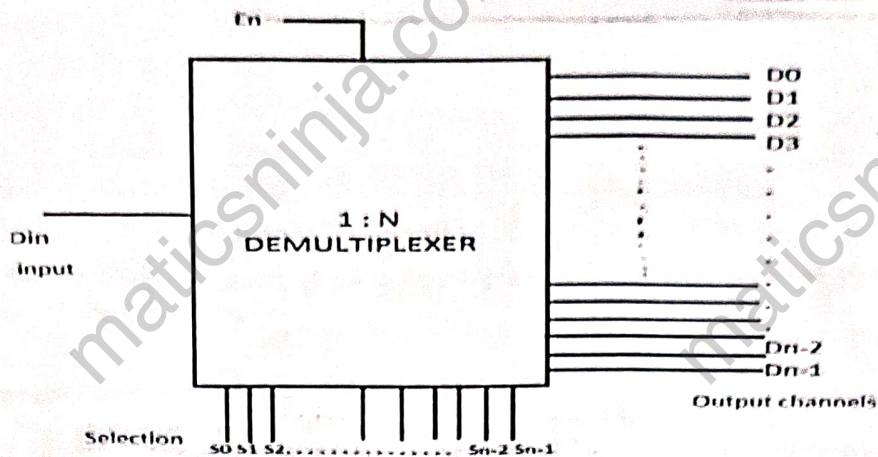


Fig 11.1: Block diagram of 1: n Demultiplexer

Courtesy: <https://www.semiconductorforu.com/wp-content/uploads/2022/09/demultiplexer.jpg>

**Types of Demultiplexer (DEMUX):**

1. 1:2 MUX (1 line to 2 lines)
2. 1:4 MUX (1 line to 4 lines)
3. 1:8 MUX (1 line to 8 lines)
4. 1:16 MUX (1 line to 16 lines)

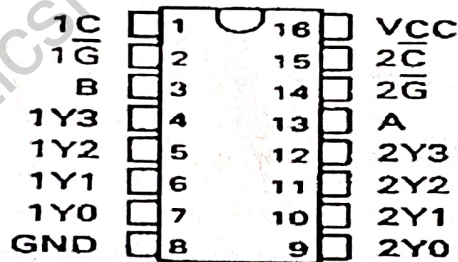


Fig 11.2 IC SN74155 1:4 Demux

Courtesy: <https://www.digchip.com/datasheets/parts/datasheet/477/SN74155-pdf.php>

**VII**

**Circuit diagram**

**a) Sample circuit**

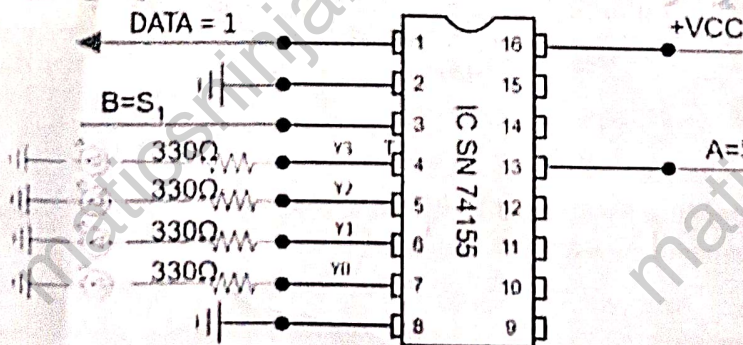
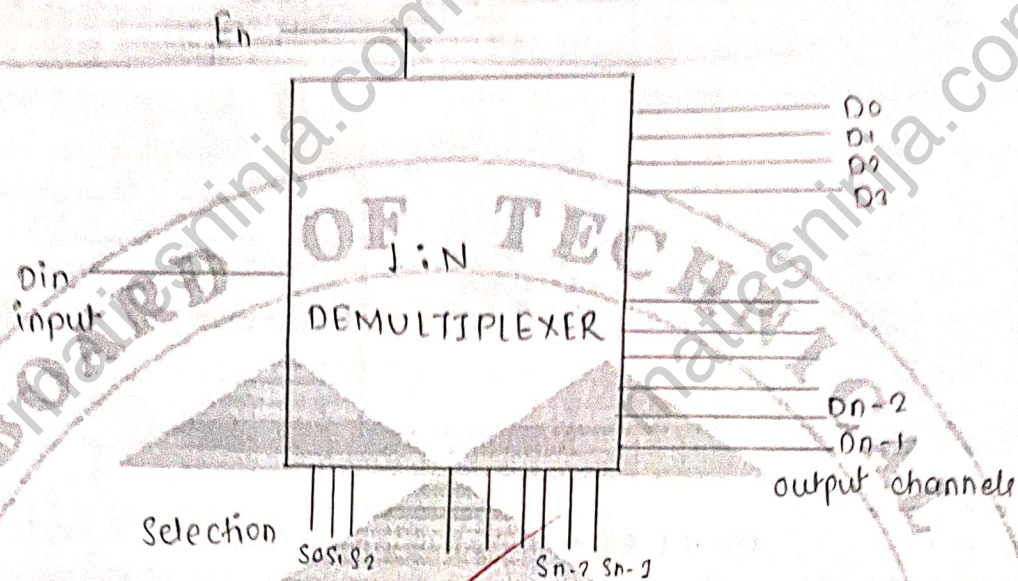


Fig 11.3 Circuit Diagram of 1: 4 DEMUX using IC SN 74155

(Note: Output of IC SN74155 is complementary to get desired output invert it by connecting NOT gate)



b) Actual circuit



VIII Resources Required

Sr. No.	Name of Resource	Suggested Broad Specification	Quantity
1	Digital Multimeter	3 ½ digit display	1 or 2
2	Digital IC Tester	Tests a wide range of digital IC's such as 74 series, 40/45 series of CMOS IC's	1
3	DC Power supply	+5 V fixed power supply or Variable DC power supply (0-30V)	1
4	Breadboard	5.5cm X 17cm	1
5	Connecting Wires	Single strand wires of 0.6 mm	As per Requirement
6	IC	SN74155	1
7	LED	Red/Yellow color 5 mm	6( 2 for Select Lines and 4 for outputs)
8	Not gate	IC 7404	1
8	Resistor	220Ω/330Ω	4

IX Precautions to be followed

- 1) Check IC before use.
- 2) Set power supply to 5V (Variable DC Power Supply) before connecting.
- 3) Check all the connections as per circuit diagram



**X Procedure**

1. Test the IC using Digital IC tester
2. Mount the IC on the breadboard
3. Make the connection as per fig 11.3.
4. Connect the +5V to +Vcc pin of IC and GND pin to ground
5. Connect the Strobe PIN  $\overline{1G}$  to ground.
6. Observe the LED (on or off) for each combination of input as per truth table
7. Verify the truth table

**XI Resources Used**

Sr. No.	Name of Resource	Suggested Broad Specification	Quantity
1	Breadboard	5.5cm x 17 cm	1
2	IC	SN74155	1
3	NOT gate	IC 7404	1
4	resistor	220- $\Omega$ / 330- $\Omega$	4

**XII Actual Procedure**

- .....
- 1> Test the IC using digital IC tester
  - 2> Mount the IC on the breadboard
  - 3> Make the connections as per fig. 11.3
- .....

**XIII Observation:**

Table 11.1: Observation Table

Inputs				Outputs				Outputs (Volts)			
Select		Strobe $\overline{1G}$	Data IC	Y <sub>0</sub>	Y <sub>1</sub>	Y <sub>2</sub>	Y <sub>3</sub>	Y <sub>0</sub>	Y <sub>1</sub>	Y <sub>2</sub>	Y <sub>3</sub>
B	A										
X	X	1	X	X	X	X	X	X	X	X	X
0 (0V)	0 (0V)	0	1	1	0	0	0	5	0	0	0
0 (0V)	1 (5V)	0	1	0	1	0	0	0	5	0	0
1 (5V)	0 (0V)	0	1	0	0	1	0	0	0	5	0
1 (5V)	1 (5V)	0	1	0	0	0	1	0	0	0	5

(Write the observation with respect to Inputs)

(Note: 'X' indicates the don't care condition. It means the status of selected input may be any combination)



#### XIV Result(s)

In this practical we learnt about to build and test the functionality of 1:4/1:8 demultiplexer.

#### XV Interpretation of results

In this practical we observe the functionality of 1:4/8 demultiplexer to build & test.

#### XVI Conclusion and recommendation

Hence we learnt to build & test the functionality of 1:4/8 demultiplexer.

#### XVII Practical related questions

Note: Below given are few sample questions for reference. Teacher must design more such questions so as to ensure the achievement of identifies CO.

1. List the function of Strobe (G) pin?
2. List the name of manufacturers of IC'S used for this practical ?
3. Draw the Circuit diagram for 1:8 DeMUX using IC SN 74155 and its truth table?
4. State how DEMUX have helped for Data transfer in electronic circuits?

[Space for Answers]

Q11 →

→ Data transmission

→ Synchronization

→ Control signal

→ Timing

Q12 → → Texas instruments

→ microchip technology

→ NXP Semiconductor

→ Analog device

→ ST microelectronics

→ maxim integrated

Q13 → Demultiplexer (demux) play a crucial role in data transfer within electronic circuit.

→ signal routing

→ faster resource utilization

→ data distribution



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Q.1) →

- 1) Data transmission
- 2) Synchronization
- 3) Control signal
- 4) Timing

Q.2) → 1) Texas instruments

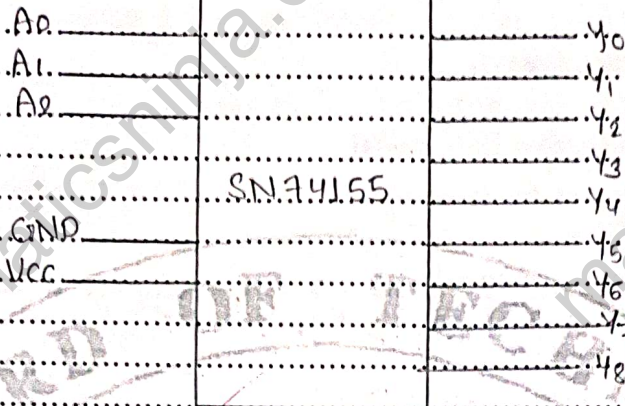
- 2) microchip technology
- 3) NXP Semiconductor
- 4) Analog device
- 5) st microelectronics
- 6) maxim integrated

Q.4) → Demultiplexer (Demux) play a crucial role in data transfer within electronic circuit.

- 1) Signal routing
- 2) Effedent resource utilization
- 3) Data distribution



Q.3] →



**XVIII References/Suggestions for further reading**

1. <https://www.digchip.com/datasheets/parts/datasheet/477/SN74155-pdf.php>
2. [https://www.youtube.com/watch?v=3aWLCH9\\_EPA](https://www.youtube.com/watch?v=3aWLCH9_EPA) (NPTEL Video Link on Demultiplexer)

**XIX Assessment Scheme**

Performance Indicators		Weightage
<b>Process Related : 15 Marks</b>		<b>60 %</b>
1	Handling of the components	10%
2	identification of components	20%
3	Measuring value using suitable instrument	20%
4	working in teams	10%
<b>Product Related: 10 Marks</b>		<b>40%</b>
5	Calculated theoretical values of given component	10%
6	Interpretation of result	05%
7	Conclusion	05%
8	Practical related questions	15%
9	Submitting the journal in time	05%
<b>Total ( 25 Marks)</b>		<b>100 %</b>

Marks Obtained			Dated signature of Teacher
Process related (15)	Product related (10)	Total (25)	
13	10	23	