Encoder

Design.v | Untitled 1

D:/Vivado/Encoder/Encoder.srcs/sources_1/new/Design.v

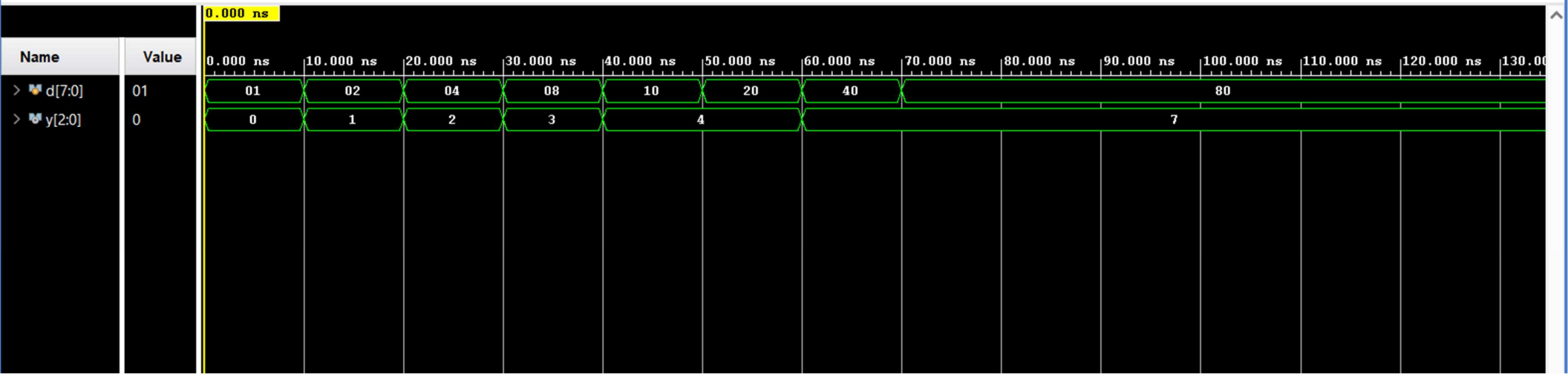
```
1  //8:3 encoder design code
2  module encoder(d,y);
3    input[7:0]d;
4    output[2:0]y;
5    assign y[2]=d[4]|d[5]|d[6]|d[7];
6    assign y[1]=d[2]|d[3]|d[6]|d[7];
7    assign y[0]=d[1]|d[3]|d[6]|d[7];
8  endmodule
```

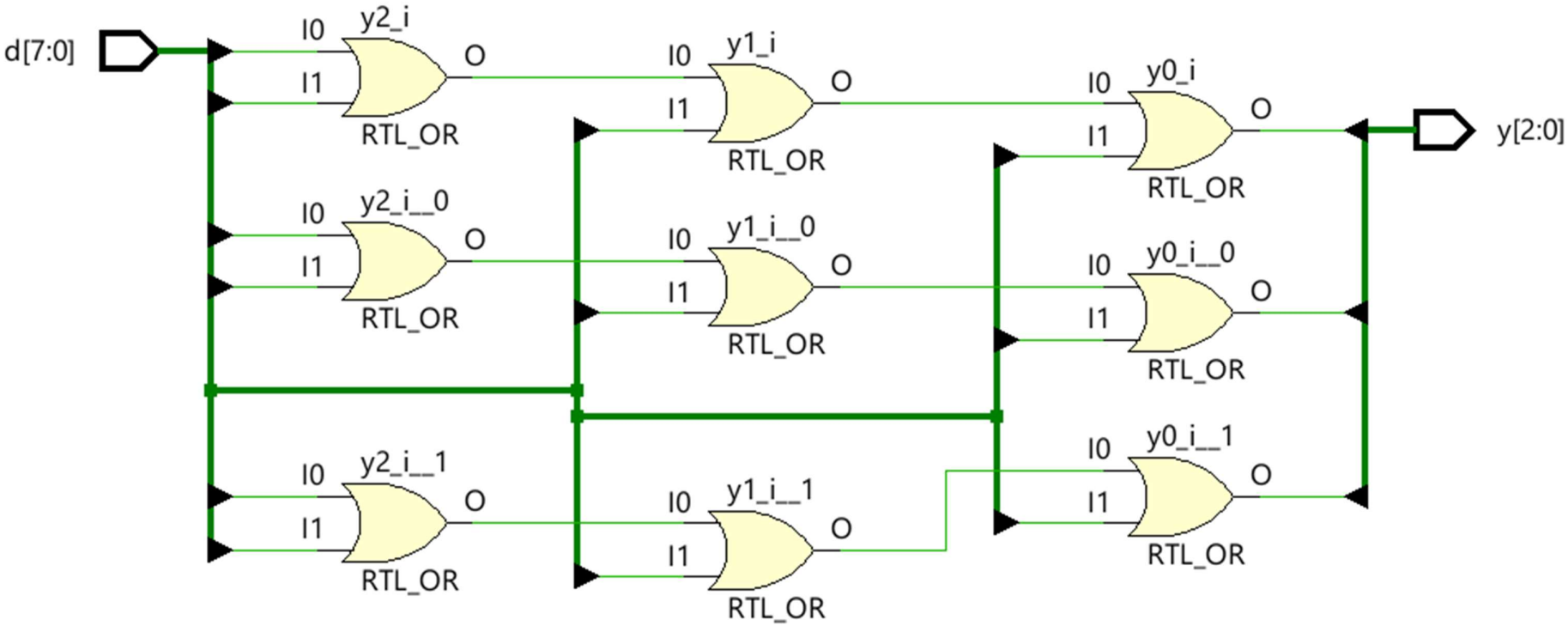
testbench.v

D:/Vivado/Encoder/Encoder.srcs/sim_1/new/testbench.v

```
1  //8:3 encoder test bench
2  module tb;
3    reg [7:0]d;
4    wire[2:0]y;
5    encoder u1(.y(y),.d(d));
6    initial
7      begin
8        $monitor("d=%0b,y=%0b",d,y);
9        d=8'b00000001;
10     #10d=8'b00000010;
11     #10d=8'b00000100;
12     #10d=8'b00001000;
13     #10d=8'b00010000;
14     #10d=8'b00100000;
15     #10d=8'b01000000;
16     #10d=8'b10000000;
17      end
18 endmodule
```

Design.v | testbench.v | Untitled 1





OUT PUT TEST CASE

```
# KERNEL: d=1,y=0
# KERNEL: d=10,y=1
# KERNEL: d=100,y=10
# KERNEL: d=1000,y=11
# KERNEL: d=10000,y=100
# KERNEL: d=100000,y=100
# KERNEL: d=1000000,y=111
# KERNEL: d=10000000,y=111
# KERNEL: Simulation has finished.
```

An **encoder** is a device or process that converts information from one format to another, typically for purposes of compatibility, efficiency, or standardization. Encoders are widely used in various fields, such as electronics, computing, automation, and machine learning. Here are the key concepts:

Basic Definition

- **General Purpose:** An encoder transforms data, motion, or signals into a specific format for processing, storage, or transmission.
- **Physical Motion to Digital Signal:** In industrial and automation contexts, encoders convert mechanical motion (e.g., rotation or linear displacement) into an electrical signal that can be interpreted by control systems16.

Types of Encoders

1. **Rotary Encoders:**
    - Measure rotational position or speed.
    - Common in motors and robotics.
2. **Linear Encoders:**
    - Measure straight-line motion.
3. **Absolute Encoders:**
    - Provide unique position values for every location.
4. **Incremental Encoders:**
    - Provide relative position changes through pulses.

Applications

- **Industrial Automation:** Used in CNC machines, robotics, and motor control to ensure precise movement and positioning16.
- **Data Communication:** Encoding ensures efficient data transmission by converting information into standardized formats like ASCII or Unicode23.
- **Machine Learning:** In encoder-decoder architectures (e.g., for translation), encoders convert input sequences into vector representations for further processing by decoders5.

Key Components

1. **Sensing Element:** Detects physical motion (e.g., light beams in optical encoders).
2. **Signal Converter:** Translates detected motion into an electrical signal.
3. **Output Interface:** Processes and communicates the signal to a control system16.

Encoders are indispensable in modern technology due to their role in translating physical or digital inputs into actionable data across diverse applications.