

# Device Modeling Report

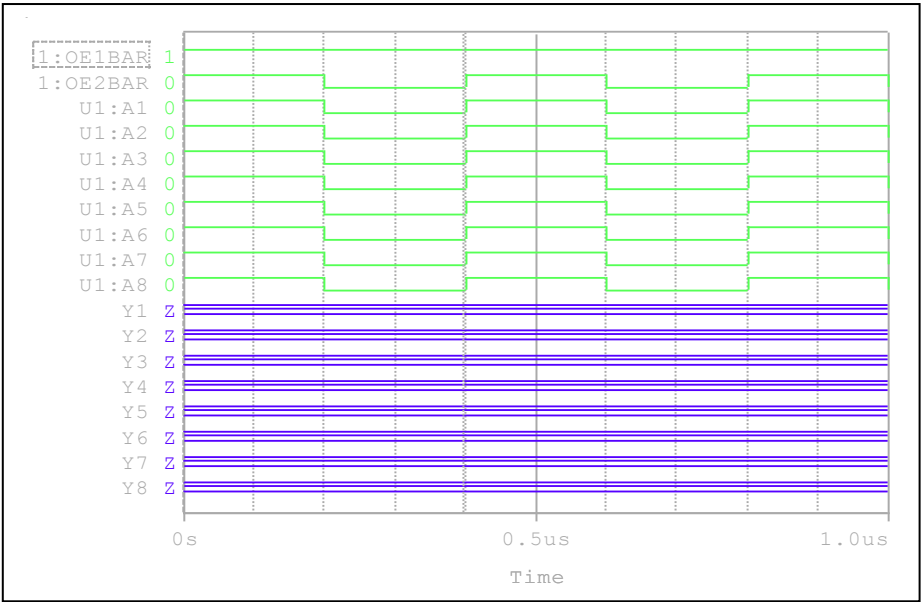
COMPONENTS : CMOS DIGITAL INTEGRATED CIRCUIT  
PART NUMBER : TC74VHC541F  
MANUFACTURER : TOSHIBA



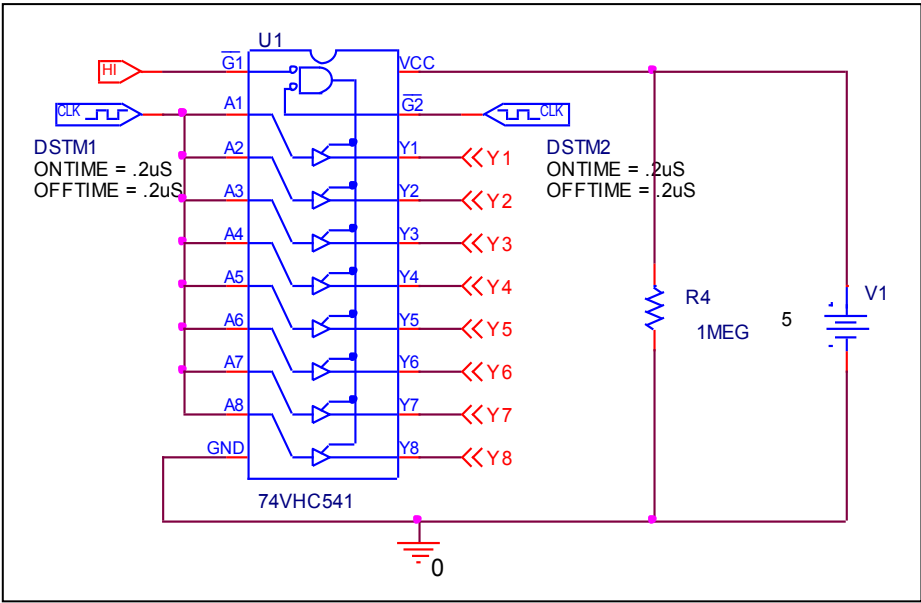
**Bee Technologies Inc.**

# Truth Table

## Circuit simulation result



## Evaluation circuit

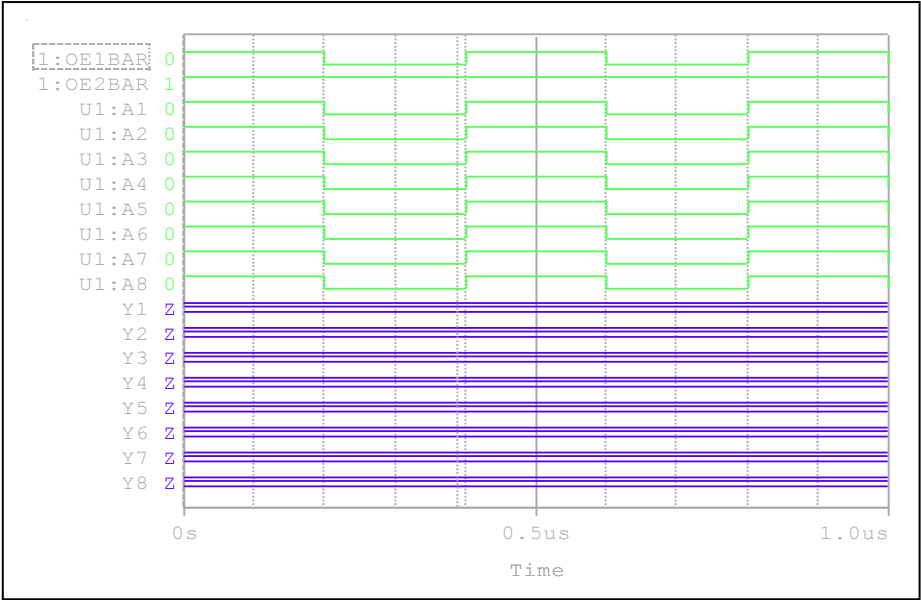


## Comparison table

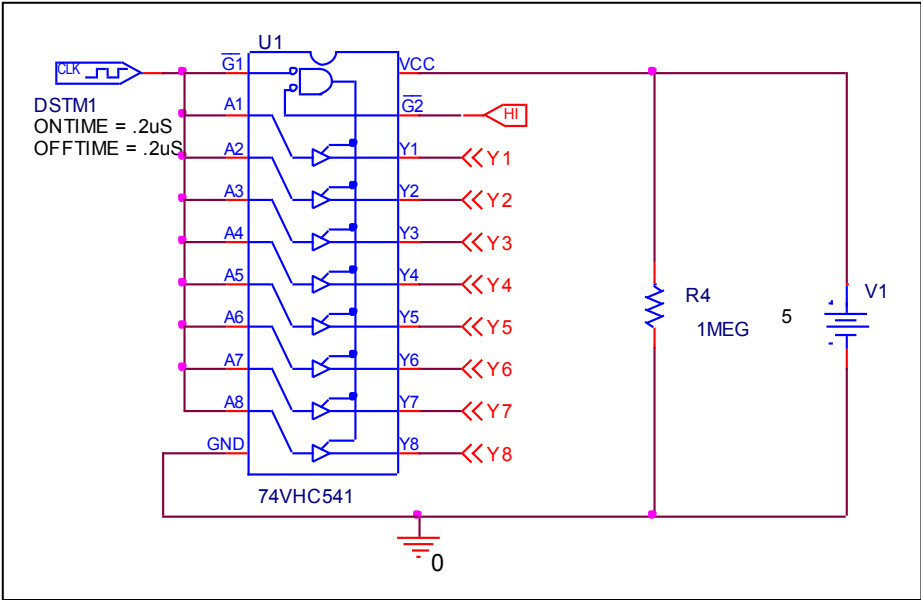
| Input |    |    | Output           |                 | %Error |
|-------|----|----|------------------|-----------------|--------|
| G1    | G2 | An | Yn (Measurement) | Yn (Simulation) |        |
| H     | X  | X  | Z                | Z               | 0      |

# Truth Table

## Circuit simulation result



## Evaluation circuit

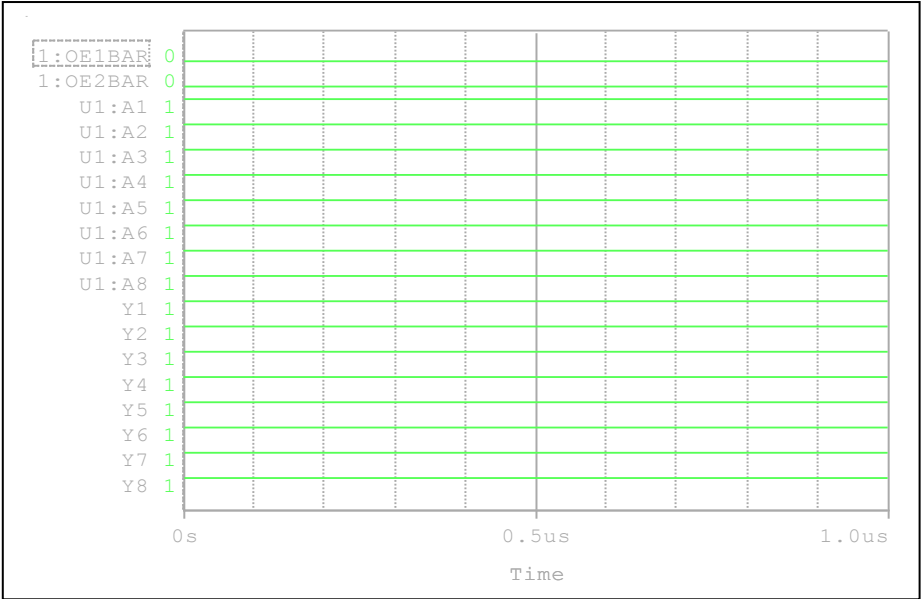


## Comparison table

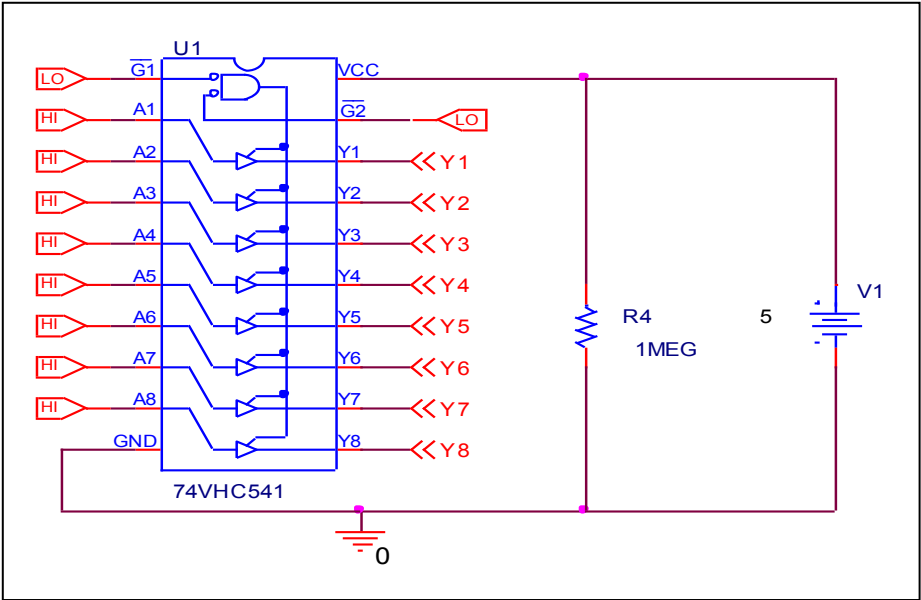
| Input |    |    | Output           |                 | %Error |
|-------|----|----|------------------|-----------------|--------|
| G1    | G2 | An | Yn (Measurement) | Yn (Simulation) |        |
| X     | H  | X  | Z                | Z               | 0      |

# Truth Table

Circuit simulation result



Evaluation circuit

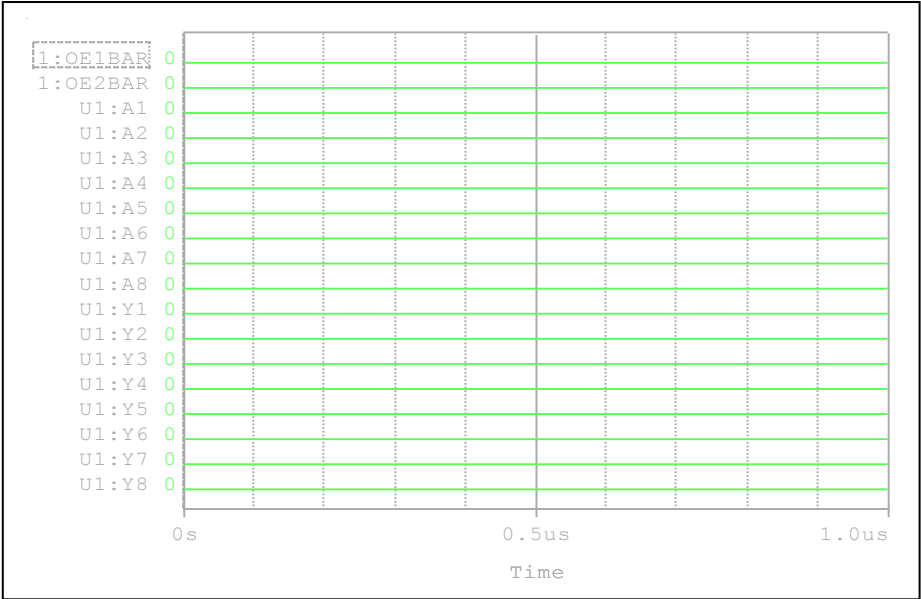


Comparison table

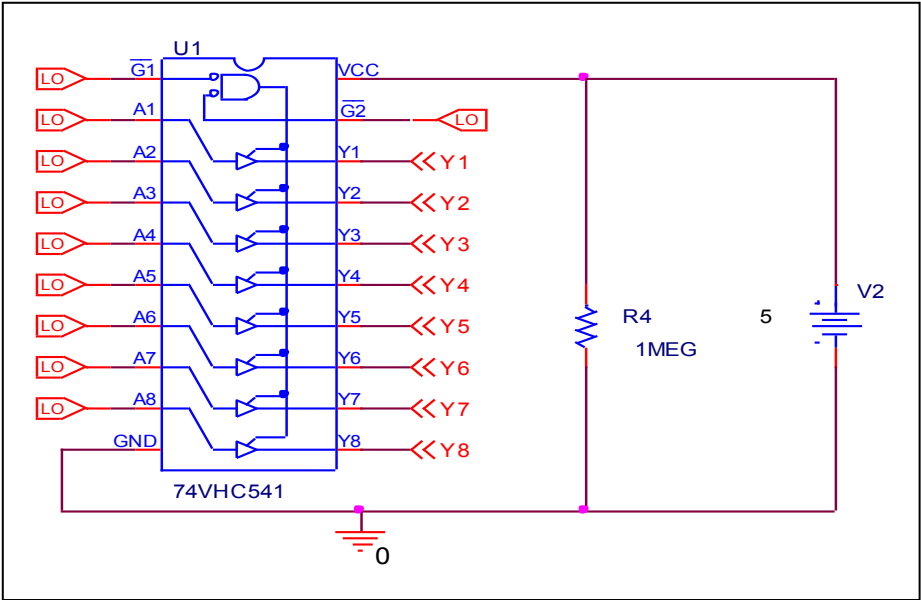
| Input |    |    | Output           |                 | %Error |
|-------|----|----|------------------|-----------------|--------|
| G1    | G2 | An | Yn (Measurement) | Yn (Simulation) |        |
| L     | L  | H  | H                | H               | 0      |

# Truth Table

Circuit simulation result



Evaluation circuit

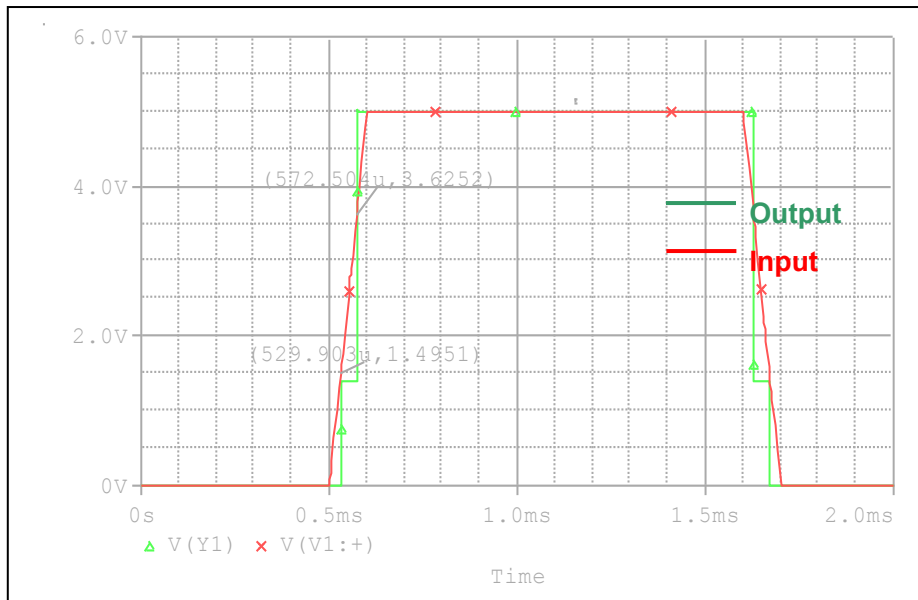


Comparison table

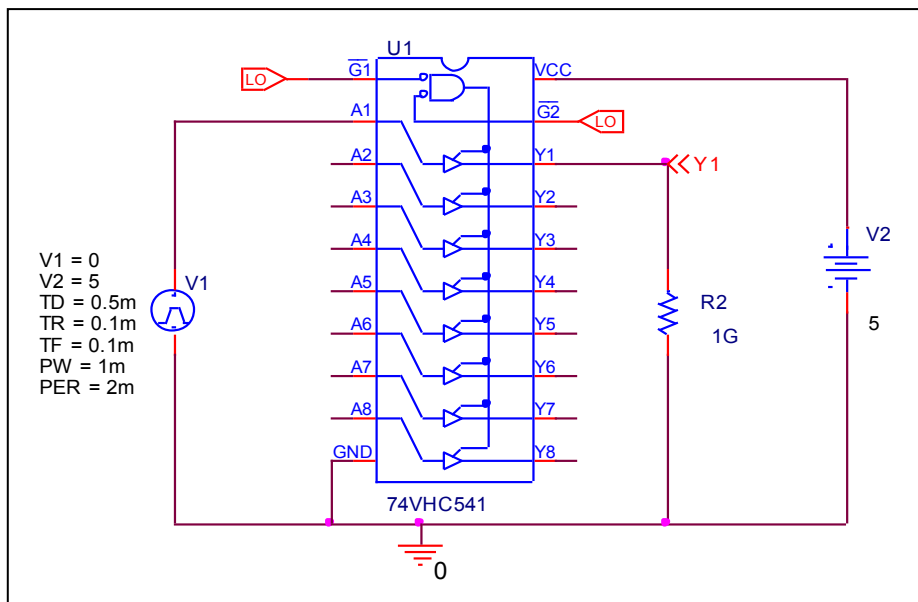
| Input |    |    | Output           |                 | %Error |
|-------|----|----|------------------|-----------------|--------|
| G1    | G2 | An | Yn (Measurement) | Yn (Simulation) |        |
| L     | L  | L  | L                | L               | 0      |

## High Level and Low Level Input Voltage

### Circuit simulation result



### Evaluation circuit

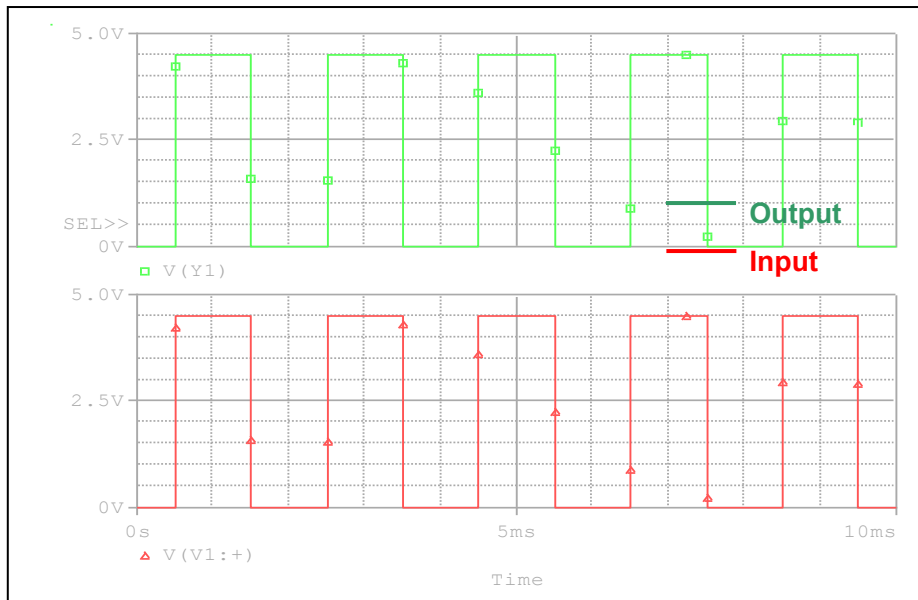


### Comparison table

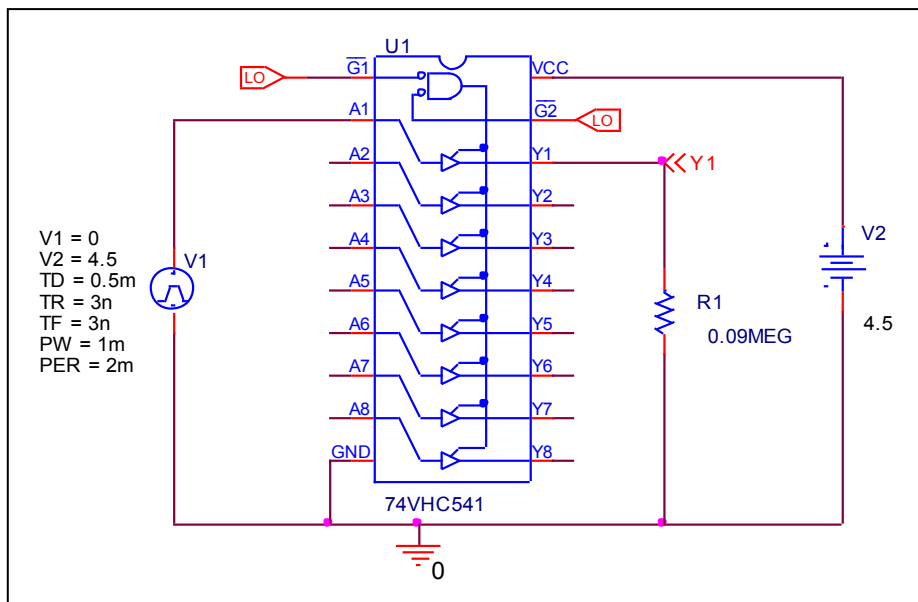
| $V_{CC} = 5V$                         | Measurement | Simulation | %Error |
|---------------------------------------|-------------|------------|--------|
| Min $V_{IH} = (V_{CC} \cdot 0.7) (V)$ | 3.5         | 3.6252     | 3.577  |
| Min $V_{IL} = (V_{CC} \cdot 0.3) (V)$ | 1.5         | 1.4951     | -0.327 |

## High Level and Low Level Output Voltage

### Circuit simulation result



### Evaluation circuit

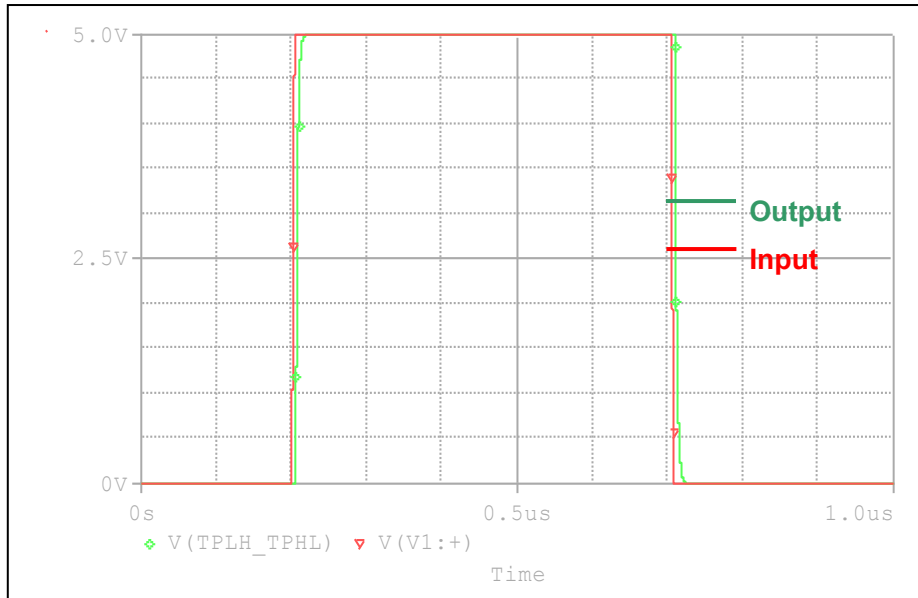


### Comparison table

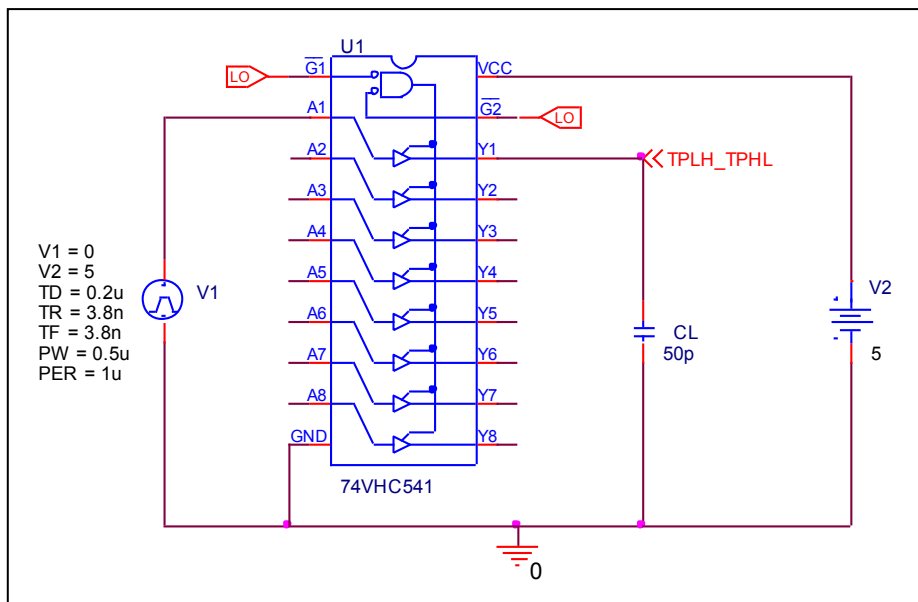
| $V_{CC} = 4.5V$ | Measurement | Simulation | %Error |
|-----------------|-------------|------------|--------|
| $V_{OH} (V)$    | 4.5         | 4.4978     | -0.049 |
| $V_{OL} (V)$    | 0           | 0          | 0      |

## Propagation Delay Time

### Circuit simulation result



### Evaluation circuit

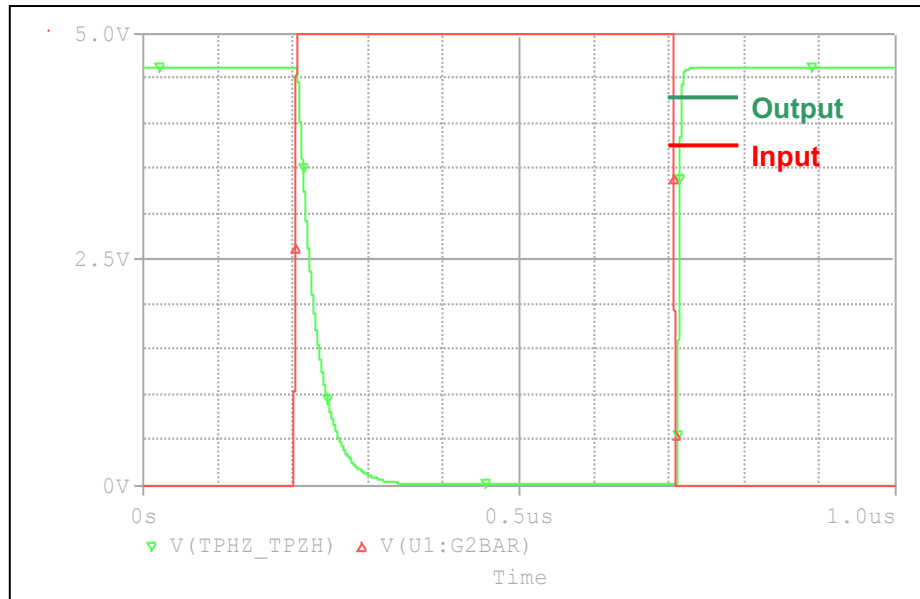


### Comparison table $C_L = 50 \text{ pF}$

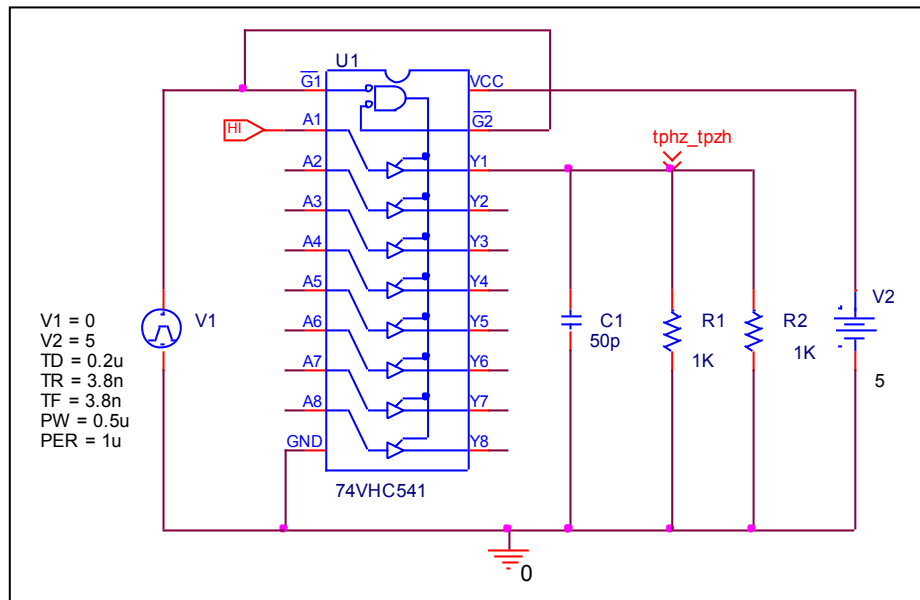
| $V_{CC} = 5 \text{ V}$ , $t_r = t_f = 3 \text{ ns}$ | Measurement | Simulation | %Error |
|-----------------------------------------------------|-------------|------------|--------|
| $t_{pLH} \text{ (ns)}$                              | 5           | 5.0511     | 1.022  |
| $t_{pHL} \text{ (ns)}$                              | 5           | 5.0809     | 1.618  |

**Output enable time, high impedance (off) to high output ( $t_{PZH}$ )**  
**Output disable time, high to high impedance (off) output ( $t_{PHZ}$ )**

**Circuit simulation result**



**Evaluation circuit**

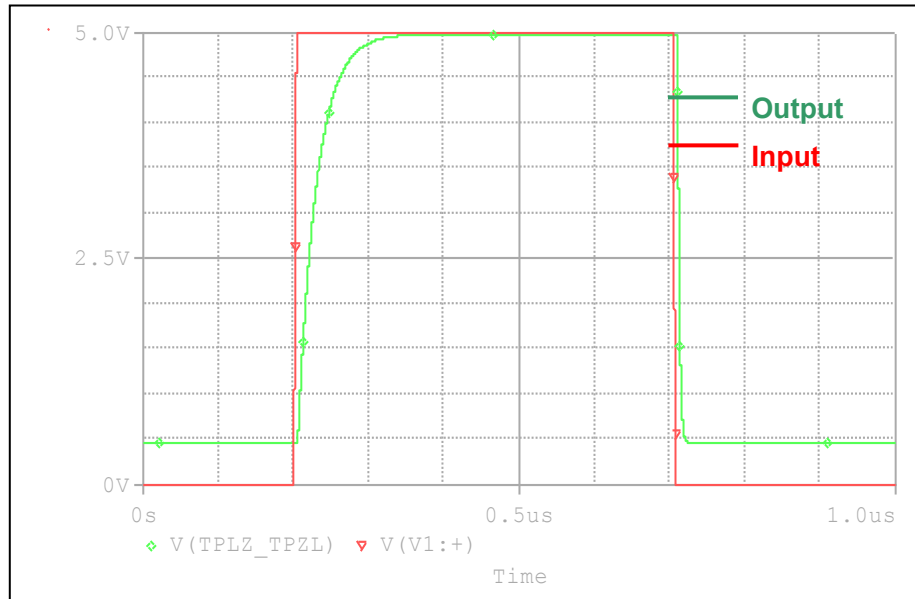


**Comparison table**  $C_L = 50 \text{ pF}$ ,  $R_L = 1 \text{ K}\Omega$

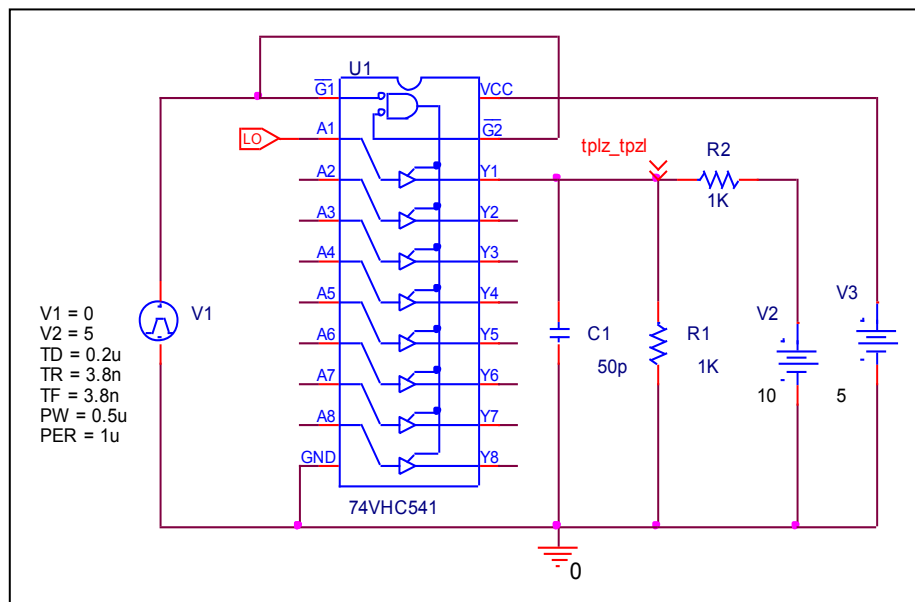
| $V_{CC} = 5 \text{ V}$ , $t_r = t_f = 3 \text{ ns}$ | Measurement | Simulation | %Error |
|-----------------------------------------------------|-------------|------------|--------|
| $t_{PHZ} \text{ (ns)}$                              | 6           | 6.0542     | 0.903  |
| $t_{pZH} \text{ (ns)}$                              | 6.2         | 6.2423     | 0.682  |

**Output enable time, high impedance (off) to low output ( $t_{PZL}$ )**  
**Output disable time, low to high impedance (off) output ( $t_{PLZ}$ )**

**Circuit simulation result**



**Evaluation circuit**



**Comparison table**  $C_L = 50 \text{ pF}$ ,  $R_L = 1 \text{ K}\Omega$

| $V_{CC} = 5 \text{ V}$ , $t_r = t_f = 3 \text{ ns}$ | Measurement | Simulation | %Error |
|-----------------------------------------------------|-------------|------------|--------|
| $t_{PLZ} \text{ (ns)}$                              | 6           | 6.0557     | 0.928  |
| $t_{pZL} \text{ (ns)}$                              | 6.2         | 6.2378     | 0.610  |