

# HD75153

## Quadruple Differential Line Drivers With 3 State Outputs

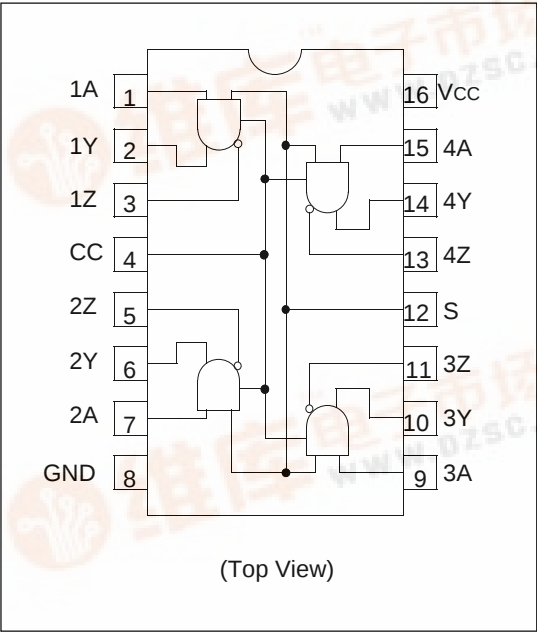
HD75153 features line drivers which satisfy the requirements of EIA RS 422 A and Federal Standard 1020. This device is designed to provide differential signals with high current capability on bus lines. The circuit provides strobe and enable inputs to control all four drivers. The output circuit has active pull up and pull down and is capable of sinking or sourcing 40 mA.

Function Table

| Input        |             |           | Output |   |
|--------------|-------------|-----------|--------|---|
| Enable<br>CC | Strobe<br>S | Data<br>A | Y      | Z |
| L            | X           | X         | Z      | Z |
| H            | L           | X         | L      | H |
| H            | X           | L         | L      | H |
| H            | H           | H         | H      | L |

H : High level  
L : Low level  
X : Irrelevant  
Z : High impedance

Pin Arrangement



### Absolute Maximum Ratings

| Item                                       | Symbol           | Rating      | Unit |
|--------------------------------------------|------------------|-------------|------|
| Supply Voltage                             | V <sub>CC</sub>  | 7           | V    |
| Input Voltage                              | V <sub>IN</sub>  | 5.5         | V    |
| Power Dissipation (T <sub>a</sub> = 25 °C) | P <sub>T</sub>   | DP          | 1000 |
|                                            |                  | FP          | 785  |
|                                            |                  |             | mW   |
| Operating Temperature Range                | T <sub>opr</sub> | 0 to +70    | °C   |
| Storage Temperature Range                  | T <sub>stg</sub> | −60 to +150 | °C   |

Note: 1. The above data were taken by the  $\Delta V_{BE}$  method, mounting on a glass epoxy board (40 × 40 × 1.6 mm) of 10 % wiring density.

2. The absolute maximum ratings are values which must not individually be exceeded, and furthermore, no two of which may be realized at the same time.

### Recommended Operating Conditions

| Item                       | Symbol             | Min   | Typ | Max  | Unit |
|----------------------------|--------------------|-------|-----|------|------|
| Supply Voltage             | V <sub>CC</sub>    | 4.75  | 500 | 5.25 | V    |
| Common Mode Output Voltage | V <sub>out C</sub> | −0.25 |     | 6    | V    |
| Output Current             | I <sub>OH</sub>    | —     | —   | −40  | mA   |
| Output Current             | I <sub>OL</sub>    | —     | —   | 40   | mA   |
| Operating Temperature      | T <sub>opr</sub>   | 0     | —   | 70   | °C   |

### Electrical Characteristics (T<sub>a</sub> = 0 to 70 °C)

| Item                                               | Symbol                        | Conditions                                                                                        | Min                                                                                  | Typ <sup>*1</sup> | Max                | Unit |
|----------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-------------------|--------------------|------|
| Input Voltage                                      | V <sub>IH</sub>               |                                                                                                   | 2                                                                                    | —                 | —                  | V    |
|                                                    | V <sub>IL</sub>               |                                                                                                   | —                                                                                    | —                 | 0.8                | V    |
| Input Clamp Voltage                                | V <sub>IK</sub>               | V <sub>CC</sub> = 4.75 V<br>I <sub>I</sub> = −12 mA                                               | CC, S                                                                                | —                 | —                  | V    |
|                                                    |                               |                                                                                                   | All Others                                                                           | −0.9              | −1.5               | V    |
| Output Voltage                                     | V <sub>OH</sub>               | V <sub>CC</sub> = 4.75 V, V <sub>IL</sub> = 0.8 V<br>V <sub>IH</sub> = 2 V                        | I <sub>OH</sub> = −20 mA<br>I <sub>OH</sub> = −40 mA                                 | 2.5<br>2.4        | —                  | V    |
|                                                    | V <sub>OL</sub>               | V <sub>CC</sub> = 4.75 V, V <sub>IL</sub> = 0.8 V, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 40 mA |                                                                                      | —                 | 0.5                | V    |
|                                                    | V <sub>OD1</sub>              | V <sub>CC</sub> = 5.25 V, I <sub>O</sub> = 0                                                      |                                                                                      | 3.4               | 2 V <sub>OD2</sub> | V    |
| Differential Output Voltage                        | V <sub>OD2</sub>              | V <sub>CC</sub> = 4.75 V<br>R <sub>L</sub> = 100 Ω <sup>*5</sup>                                  | 2                                                                                    | 2.8               | —                  | V    |
| Change In Magnitude Of Differential Output Voltage | Δ V <sub>OD</sub>             | <sup>*2</sup> V <sub>CC</sub> = 4.75 V                                                            | —                                                                                    | 0.01              | 0.4                | V    |
| Common Mode Output Voltage                         | V <sub>OC</sub> <sup>*3</sup> | V <sub>CC</sub> = 5.25 V                                                                          | —                                                                                    | 1.8               | 3                  | V    |
|                                                    |                               | V <sub>CC</sub> = 4.75 V                                                                          | —                                                                                    | 1.6               | 3                  | V    |
| Change In Magnitude Of Common Mode Output Voltage  | Δ V <sub>OC</sub>             | <sup>*2</sup> V <sub>CC</sub> = 4.75 V or 5.25 V                                                  | —                                                                                    | 0.02              | 0.4                | V    |
| Off State (High Impedance State) Output Current    | I <sub>OZ</sub>               | V <sub>CC</sub> = 5.25 V<br>Enable = 0.8 V                                                        | V <sub>O</sub> = 0.5 V<br>V <sub>O</sub> = 2.5 V<br>V <sub>O</sub> = V <sub>CC</sub> | —                 | —                  | μA   |
|                                                    |                               |                                                                                                   |                                                                                      | —                 | —                  | 20   |
|                                                    |                               |                                                                                                   |                                                                                      | —                 | —                  | 20   |

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| Item                          | Symbol                        | Conditions                                       | Min                             | Typ <sup>*1</sup> | Max  | Unit  |    |
|-------------------------------|-------------------------------|--------------------------------------------------|---------------------------------|-------------------|------|-------|----|
| Output Current With Power Off | I <sub>O</sub>                | V <sub>CC</sub> = 0 V                            | V <sub>O</sub> = 6 V            | —                 | 0.1  | 100   | μA |
|                               |                               |                                                  | V <sub>O</sub> = −0.25 V        | —                 | −0.1 | −100  |    |
|                               |                               |                                                  | V <sub>O</sub> = −0.25 V to 6 V | —                 | —    | ±100  |    |
| Input Current                 | I <sub>I</sub>                | V <sub>CC</sub> = 5.25 V, V <sub>I</sub> = 5.5 V | —                               | —                 | 0.1  | mA    |    |
|                               | I <sub>IH</sub>               | V <sub>CC</sub> = 5.25 V                         | A                               | —                 | —    | 20    | μA |
|                               |                               | V <sub>I</sub> = 2.4 V                           | CC, S                           | —                 | —    | 80    |    |
|                               | I <sub>IL</sub>               | V <sub>CC</sub> = 5.25 V                         | A                               | —                 | —    | −0.36 | mA |
|                               |                               | V <sub>I</sub> = 0.4 V                           | CC,S                            | —                 | —    | −1.6  |    |
| Short Circuit Output Current  | I <sub>OS</sub> <sup>*4</sup> | V <sub>CC</sub> = 5.25 V                         | −50                             | −90               | −150 | mA    |    |
| Supply Current                | I <sub>CC</sub>               | V <sub>CC</sub> = 5.25 V No Load                 | Outputs Disabled                | —                 | 30   | 60    | mA |
|                               |                               |                                                  | Outputs Enabled                 | —                 | 60   | 84    |    |

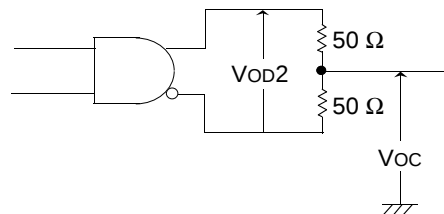
Notes: 1. All typical values are at V<sub>CC</sub> = 5 V, T<sub>a</sub> = 25°C.

$\Delta V_{OD}$  and  $\Delta V_{OC}$  are the changes in magnitudes of V<sub>OD</sub> and V<sub>OC</sub>, respectively, that occur when the input is changed from a high level to a low level.

2. In EIA standard RS-422A, V<sub>OC</sub>, which is the average of the two output voltages with respect to ground, is called output offset voltage, V<sub>OS</sub>.

3. Only one output should be shorted at a time, and duration of the short circuit should not exceed one second.

4. Differential and common mode output voltages.

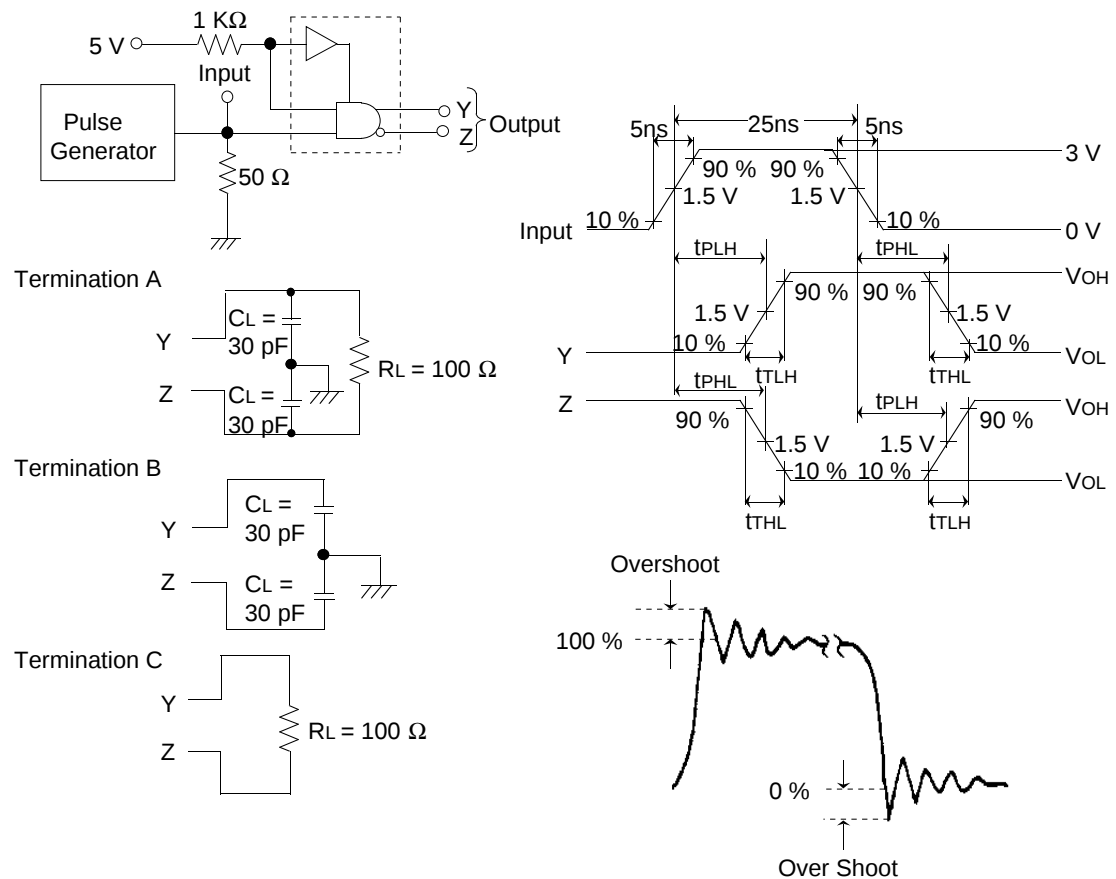


### Switching Characteristics (V<sub>CC</sub> = 5.0 V, T<sub>a</sub> = 25°C)

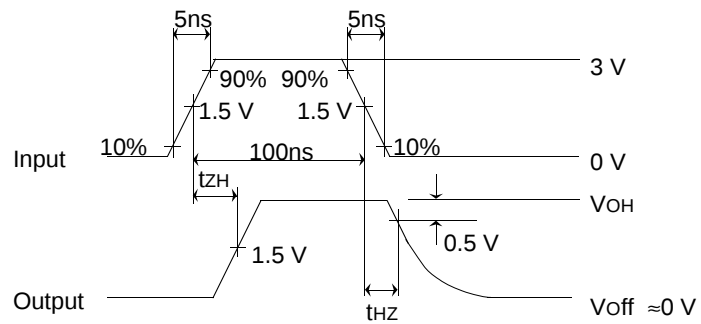
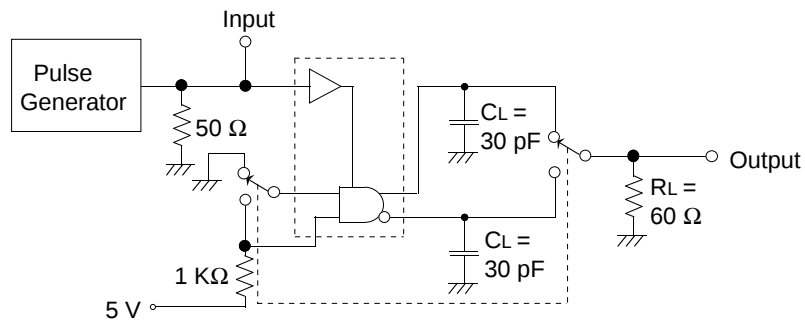
| Item                   | Symbol           | Conditions                                     | Min | Typ | Max | Unit |
|------------------------|------------------|------------------------------------------------|-----|-----|-----|------|
| Propagation Delay Time | t <sub>PLH</sub> | C <sub>L</sub> = 30 pF, R <sub>L</sub> = 100 Ω | —   | 15  | 30  | ns   |
|                        | t <sub>PHL</sub> | Termination A                                  | —   | 15  | 30  |      |
|                        | t <sub>PLH</sub> | C <sub>L</sub> = 30 pF                         | —   | 13  | 25  |      |
|                        | t <sub>PHL</sub> | Termination B                                  | —   | 13  | 25  |      |
| Transition Time        | t <sub>TLH</sub> | C <sub>L</sub> = 30 pF, R <sub>L</sub> = 100 Ω | —   | 12  | 20  | ns   |
|                        | t <sub>THL</sub> | Termination A                                  | —   | 12  | 20  |      |
| Output Enable Time     | t <sub>ZH</sub>  | C <sub>L</sub> = 30 pF, R <sub>L</sub> = 60 Ω  | —   | 18  | 35  | ns   |
|                        | t <sub>ZL</sub>  | C <sub>L</sub> = 30 pF, R <sub>L</sub> = 111 Ω | —   | 20  | 35  |      |
| Output Disable Time    | t <sub>HZ</sub>  | C <sub>L</sub> = 30 pF, R <sub>L</sub> = 60 Ω  | —   | 19  | 30  | ns   |
|                        | t <sub>LZ</sub>  | C <sub>L</sub> = 30 pF, R <sub>L</sub> = 111 Ω | —   | 13  | 30  |      |
| Overshoot Factor       |                  | R <sub>L</sub> = 100 Ω<br>Termination C        | —   | —   | 10  | %    |

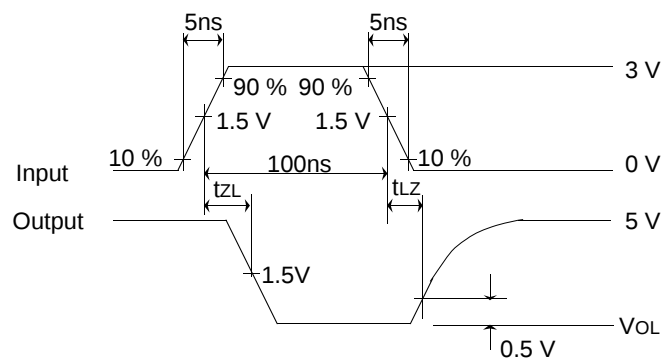
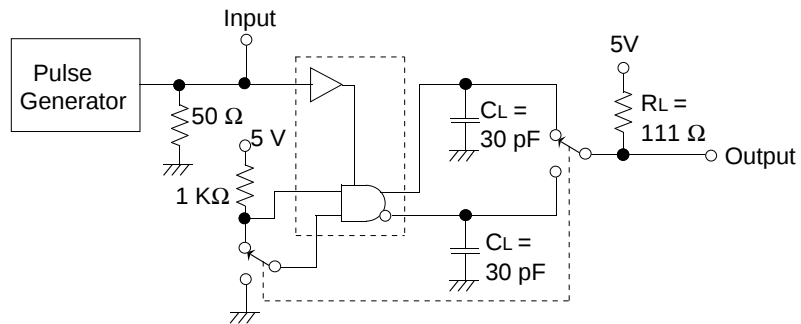
## Switching Time Test Method

## • Test circuit

1.  $t_{PLH}$ ,  $t_{PHL}$ ,  $t_{TLH}$ ,  $t_{THL}$ , and overshoot factor

2.  $t_{ZH}$ ,  $t_{HZ}$



3.  $t_{zL}$ ,  $t_{LZ}$ 

- Notes: 1. The pulse generator has the following characteristics:  
 $Z_{out} = 50 \, \Omega$ , PRR = 500 kHz  
 2.  $C_L$  includes probe and jig capacitance.