

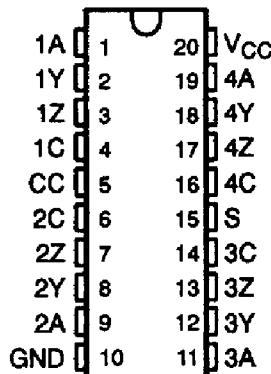
# SN75151, SN75153

## QUAD DIFFERENTIAL LINE DRIVERS WITH 3-STATE OUTPUTS

SLLS082A - D2453, DECEMBER 1978 - REVISED FEBRUARY 1993

- Meets EIA Standard RS-422-A
- High-Impedance Output State for Party-Line Operation
- High Output Impedance in Power-Off Condition
- Low Input Current to Minimize Loading
- Single 5-V Supply
- 40-mA Sink- and Source-Current Capability
- High-Speed Schottky Circuitry
- Low Power Requirements

**SN75151**  
DW OR N PACKAGE  
(TOP VIEW)

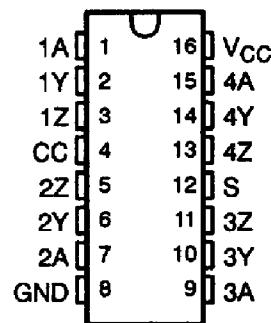


### description

These line drivers are designed to provide differential signals with high current capability on balanced lines. These circuits provide strobe and enable inputs to control all four drivers, and the SN75151 provides an additional enable input for each driver. The output circuits have active pullup and pulldown and are capable of sinking or sourcing 40 mA.

The SN75151 and SN75153 meet all requirements of EIA Standard RS-422-A and Federal Standard 1020. They are characterized for operation from 0°C to 70°C.

**SN75153**  
N PACKAGE  
(TOP VIEW)



### SN75153 NOT RECOMMENDED FOR NEW DESIGN

#### Function Tables

**SN75151**

| INPUTS       |             |             |           | OUTPUTS |   |
|--------------|-------------|-------------|-----------|---------|---|
| ENABLE<br>CC | ENABLE<br>C | STROBE<br>S | DATA<br>A | Y       | Z |
| L            | X           | X           | X         | Z       | Z |
| X            | L           | X           | X         | Z       | Z |
| H            | H           | L           | X         | L       | H |
| H            | H           | X           | L         | L       | H |
| H            | H           | H           | H         | H       | L |

**SN75153**

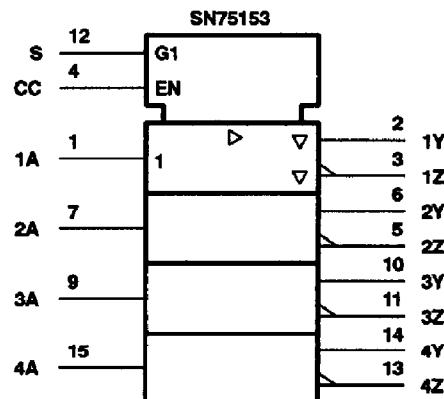
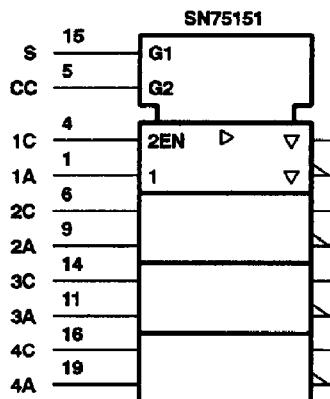
| INPUTS       |             |           |  | OUTPUTS |   |
|--------------|-------------|-----------|--|---------|---|
| ENABLE<br>CC | STROBE<br>S | DATA<br>A |  | Y       | Z |
| L            | X           | X         |  | Z       | Z |
| H            | L           | X         |  | L       | H |
| H            | X           | L         |  | L       | H |
| H            | H           | H         |  | H       | L |

# SN75151, SN75153

## QUAD DIFFERENTIAL LINE DRIVERS WITH 3-STATE OUTPUTS

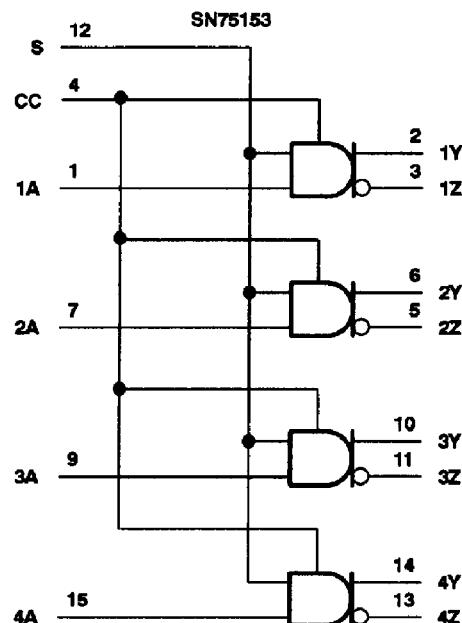
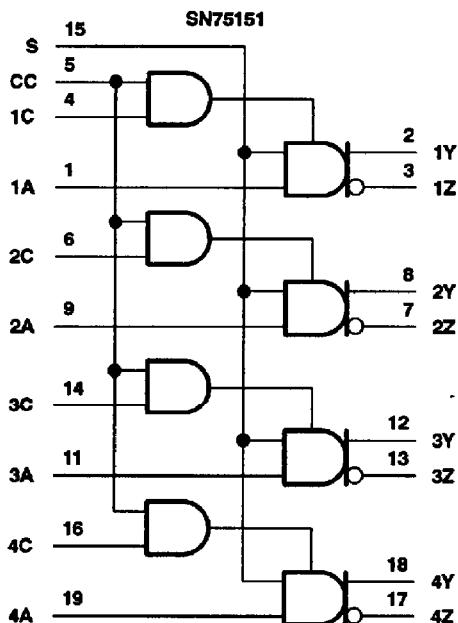
SLLS082A - D2453, DECEMBER 1978 - REVISED FEBRUARY 1993

### logic symbols†



† These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

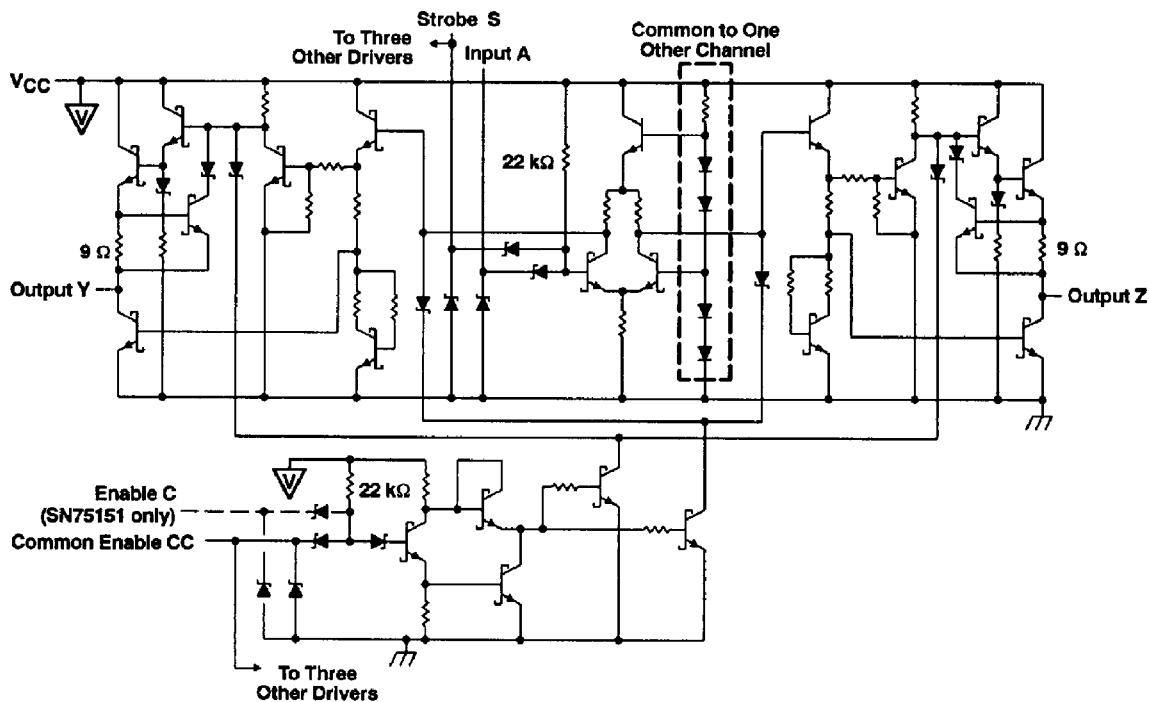
### logic diagrams (positive logic)



**SN75151, SN75153**  
**QUAD DIFFERENTIAL LINE DRIVERS WITH 3-STATE OUTPUTS**

SLLS062A - D2453, DECEMBER 1978 - REVISED FEBRUARY 1993

**schematic**



Resistor values shown are nominal.

**absolute maximum ratings over operating free-air temperature range (unless otherwise noted)**

|  |                              |
|--|------------------------------|
| Supply voltage, $V_{CC}$ (see Note 1)                        | 7 V                          |
| Input voltage, $V_I$   | 5.5 V                        |
| Continuous total dissipation                                 | See Dissipation Rating Table |
| Operating free-air temperature range                         | 0°C to 70°C                  |
| Storage temperature range                                    | -65°C to 150°C               |
| Lead temperature 1.6 mm (1/16 inch) from case for 10 seconds | 260°C                        |

NOTES: 1. All voltage values, except differential output voltage  $V_{OD}$ , are with respect to network ground terminal.

**DISSIPATION RATING TABLE**

| PACKAGE | $T_A = 25^\circ\text{C}$<br>POWER RATING | OPERATING FACTOR<br>ABOVE $T_A = 25^\circ\text{C}$ | $T_A = 70^\circ\text{C}$<br>POWER RATING |
|---------|--|--|--|
| DW      | 1125 mW                                  | 9.0 mW/ $^\circ\text{C}$                           | 720 mW                                   |
| N       | 1150 mW                                  | 9.2 mW/ $^\circ\text{C}$                           | 736 mW                                   |

**TEXAS  
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

2-351

# SN75151, SN75153 QUAD DIFFERENTIAL LINE DRIVERS WITH 3-STATE OUTPUTS

SLLS082A - D2453, DECEMBER 1978 - REVISED FEBRUARY 1993

## recommended operating conditions

|                                       | MIN   | NOM | MAX  | UNIT |
|---------------------------------------|-------|-----|------|------|
| Supply voltage, $V_{CC}$              | 4.75  | 5   | 5.25 | V    |
| High-level input voltage, $V_{IH}$    | 2     |     |      | V    |
| Low-level input voltage, $V_{IL}$     |       |     | 0.8  | V    |
| Common-mode output voltage, $V_{OC}$  | -0.25 |     | 6    | V    |
| High-level output current, $I_{OH}$   |       |     | -40  | mA   |
| Low-level output current, $I_{OL}$    |       |     | 40   | mA   |
| Operating free-air temperature, $T_A$ | 0     |     | 70   | °C   |

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER   | TEST CONDITIONS†  |   | MIN  | TYP‡              | MAX  | UNIT |
|---|---|---|------|-------------------|------|------|
|   | $V_{CC} = \text{MIN}$ , $ I  = -12 \text{ mA}$                              | $V_{CC} = \text{S}$                     |      |                   |      |      |
| $V_{IK}$ Input clamp voltage  | $V_{CC} = \text{MIN}$ , $ I  = -12 \text{ mA}$                              | $V_{IH} = 2 \text{ V}$                  | -2   |                   |      | V    |
|   |   | All others                              | -0.9 | -1.5              |      |      |
| $V_{OH}$ High-level output voltage                                  | $V_{CC} = \text{MIN}$ , $V_{IL} = \text{MAX}$ ,<br>$V_{IH} = 2 \text{ V}$   | $I_{OH} = -20 \text{ mA}$               | 2.5  |                   |      | V    |
|   |   | $I_{OH} = -40 \text{ mA}$               | 2.4  |                   |      |      |
| $V_{OL}$ Low-level output voltage                                   | $V_{CC} = \text{MIN}$ , $V_{IL} = \text{MAX}$ ,<br>$I_{OL} = 40 \text{ mA}$ | $V_{IH} = 2 \text{ V}$                  |      | 0.5               |      | V    |
| $ \Delta V_{OD} $ Differential output voltage                       | $V_{CC} = \text{MAX}$ , $I_O = 0$   |   | 3.4  | 2V <sub>OD2</sub> |      | V    |
| $ \Delta V_{OD} $ Differential output voltage                       | $V_{CC} = \text{MIN}$   | $R_L = 100 \Omega$ ,<br>See Figure 1    | 2    | 2.8               |      | V    |
| $\Delta V_{OD}$ Change in magnitude of differential output voltage§ | $V_{CC} = \text{MIN}$   |   |      | ±0.01             | ±0.4 | V    |
| $V_{OC}$ Common-mode output voltage¶                                | $V_{CC} = \text{MAX}$   |   | 1.8  | 3                 |      | V    |
|   | $V_{CC} = \text{MIN}$   |   | 1.6  | 3                 |      |      |
| $\Delta V_{OC}$ Change in magnitude of common-mode output voltage§  | $V_{CC} = \text{MIN or MAX}$  |   |      | ±0.02             | ±0.4 | V    |
| $I_{OZ}$ Off-state (high-impedance state) output current            | $V_{CC} = \text{MAX}$ , Enable at 0.8 V                                     | $V_O = 0.5 \text{ V}$                   |      | -20               |      |      |
|   |   | $V_O = 2.5 \text{ V}$                   |      | 20                |      |      |
|   |   | $V_O = V_{CC}$                          |      | 20                |      |      |
| $I_O$ Output current with power off                                 | $V_{CC} = 0$  | $V_O = 6 \text{ V}$                     | 0.1  | 100               |      |      |
|   |   | $V_O = -0.25 \text{ V}$                 | -0.1 | -100              |      |      |
|   |   | $V_O = -0.25 \text{ V to } 6 \text{ V}$ |      | ±100              |      |      |
| $I_I$ Input current at maximum input voltage                        | $V_{CC} = \text{MAX}$ , $V_I = 5.5 \text{ V}$                               |   |      | 0.1               |      | mA   |
| $I_{IH}$ High-level input current                                   | $V_{CC} = \text{MAX}$ , $V_I = 2.4 \text{ V}$                               | $C(\text{SN75151}), A$                  |      | 20                |      |      |
|   |   | $V_{CC} = \text{S}$                     |      | 80                |      | µA   |
| $I_{IL}$ Low-level input current                                    | $V_{CC} = \text{MAX}$ , $V_I = 0.4 \text{ V}$                               | $C(\text{SN75151}), A$                  |      | -0.36             |      |      |
|   |   | $V_{CC} = \text{S}$                     |      | -1.6              |      | mA   |
| $I_{OS}$ Short-circuit output current#                              | $V_{CC} = \text{MAX}$   |   | -50  | -90               | -150 | mA   |
| $I_{CC}$ Supply current (both drivers)                              | $V_{CC} = \text{MAX}$ , No load   | Outputs disabled                        | 30   | 60                |      |      |
|   |   | Outputs enabled                         | 60   | 80                |      | mA   |

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at  $T_A = 25^\circ\text{C}$  and  $V_{CC} = 5 \text{ V}$  except for  $V_{OC}$ , for which  $V_{CC}$  is as stated under test conditions.

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

¶ In EIA Standard RS-422-A,  $V_{OC}$ , which is the average of the two output voltages with respect to ground, is called output offset voltage,  $V_{OS}$ .

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

TEXAS  
INSTRUMENTS

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

SN75151, SN75153  
QUAD DIFFERENTIAL LINE DRIVERS WITH 3-STATE OUTPUTS

SLLS062A - D2453, DECEMBER 1978 - REVISED FEBRUARY 1993

**switching characteristics over recommended operating free-air temperature range,  $V_{CC} = 5$  V  
(unless otherwise noted)**

| PARAMETER   | TEST CONDITIONS                                  | MIN           | TYPT† | MAX | UNIT |
|---|--|---------------|-------|-----|------|
| tPLH Propagation delay time, low-to-high-level output | $C_L = 30$ pF,<br>See Figure 2,<br>Termination A | 15            | 30    | ns  |      |
| tPHL Propagation delay time, high-to-low-level output |  | 15            | 30    | ns  |      |
| tPLH Propagation delay time, low-to-high-level output | $C_L = 30$ pF,<br>Termination B                  | 13            | 25    | ns  |      |
| tPHL Propagation delay time, high-to-low-level output |  | 13            | 25    | ns  |      |
| tTLH Transition time, low-to-high-level output        | $C_L = 30$ pF,<br>See Figure 2,<br>Termination A | 12            | 20    | ns  |      |
| tTHL Transition time, high-to-low-level output        |  | 12            | 20    | ns  |      |
| tPZH Output enable time to high level                 | $C_L = 30$ pF,<br>See Figure 3                   | 18            | 35    | ns  |      |
| tPZL Output enable time to low level                  |  | 20            | 35    | ns  |      |
| tPHZ Output disable time from high level              | $C_L = 30$ pF,<br>See Figure 3                   | 19            | 30    | ns  |      |
| tPLZ Output disable time from low level               |  | 13            | 30    | ns  |      |
| Overshoot factor                                      | $R_L = 100 \Omega$ ,<br>Termination C            | See Figure 2, |       | 10  | %    |

† All typical values are at  $T_A = 25^\circ\text{C}$ .

---

**PARAMETER MEASUREMENT INFORMATION**

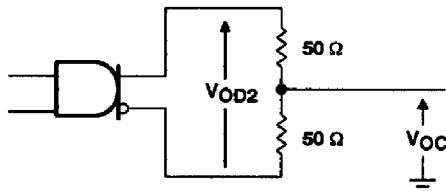


Figure 1. Differential and Common-Mode Output Voltages

**TEXAS  
INSTRUMENTS**

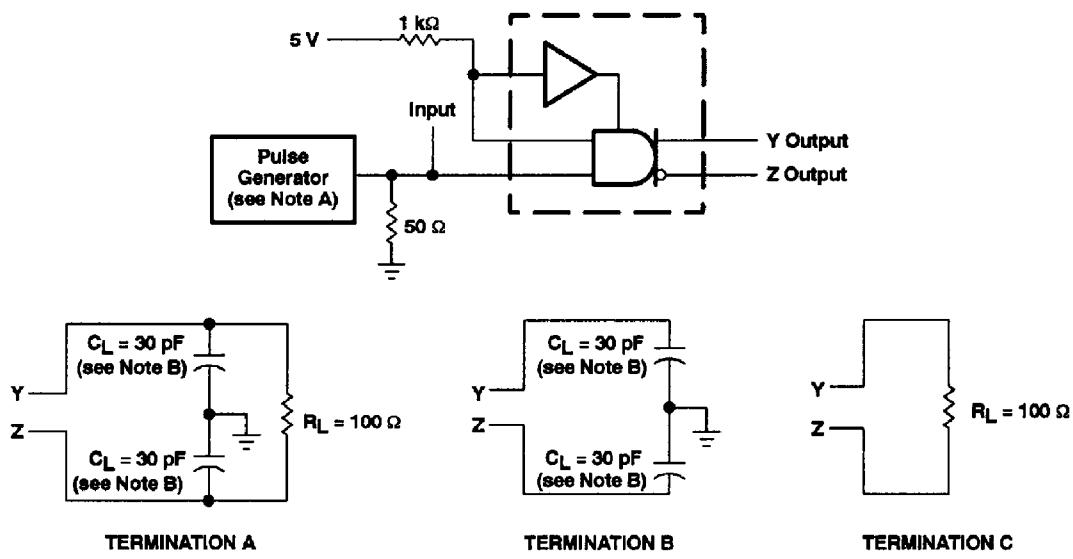
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

2-353

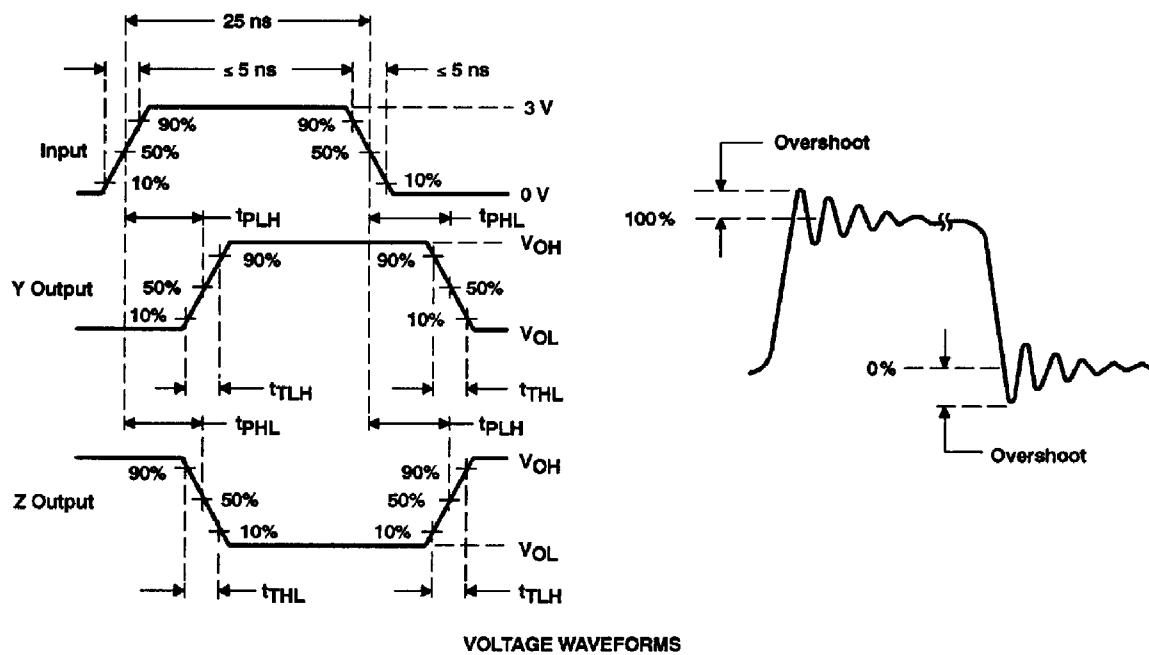
# SN75151, SN75153 QUAD DIFFERENTIAL LINE DRIVERS WITH 3-STATE OUTPUTS

SLLS082A - D2453, DECEMBER 1978 - REVISED FEBRUARY 1993

## PARAMETER MEASUREMENT INFORMATION



TEST CIRCUITS



NOTES: A. The pulse generator has the following characteristics:  $Z_0 = 50 \Omega$ , PRR  $\leq 10 \text{ MHz}$ .  
 B.  $C_L$  includes probe and jig capacitance.

Figure 2. Test Circuits, Voltage Waveforms, and Overshoot Factor

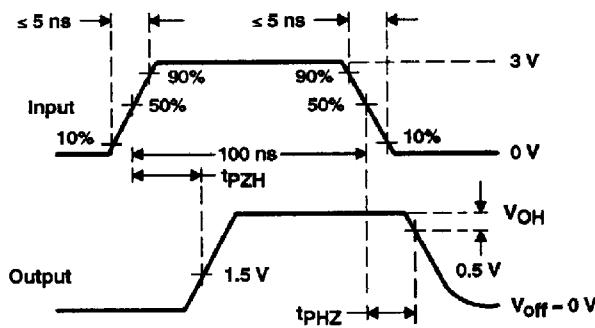
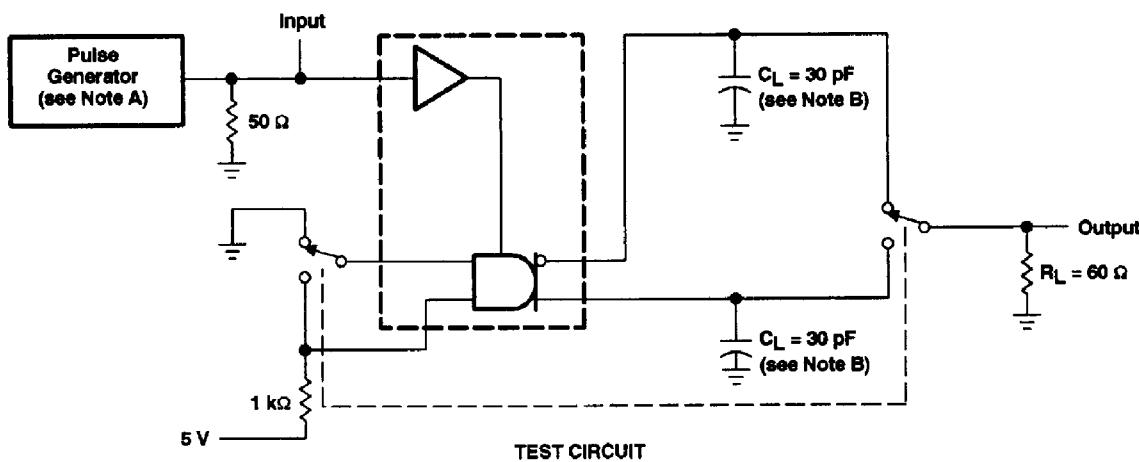
TEXAS  
INSTRUMENTS

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

**SN75151, SN75153**  
**QUAD DIFFERENTIAL LINE DRIVERS WITH 3-STATE OUTPUTS**

SLLS082A - D2453, DECEMBER 1978 - REVISED FEBRUARY 1993

**PARAMETER MEASUREMENT INFORMATION**



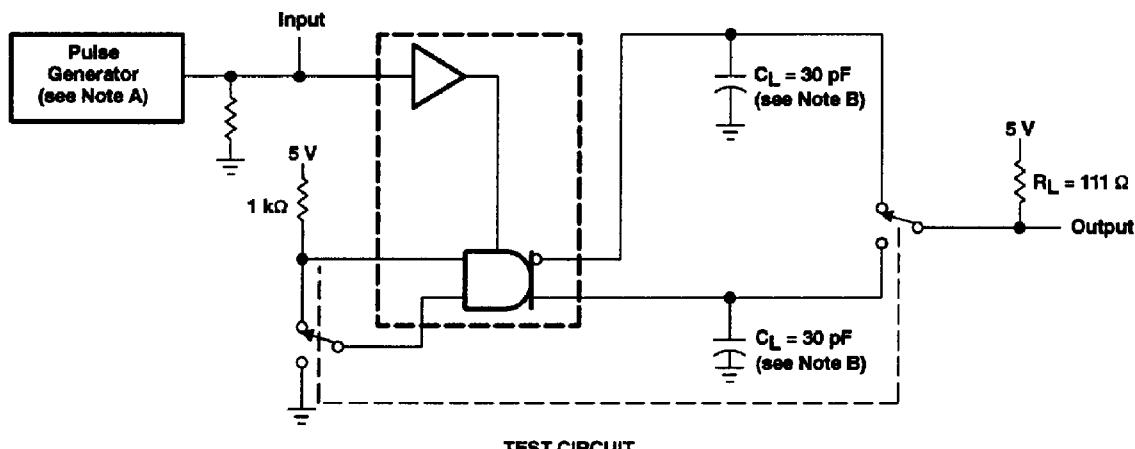
- NOTES: A. The pulse generator has the following characteristics:  $Z_O = 50 \Omega$ , PRR  $\leq 500$  kHz.  
 B.  $C_L$  includes probe and jig capacitance.

**Figure 3. Test Circuit and Voltage Waveforms**

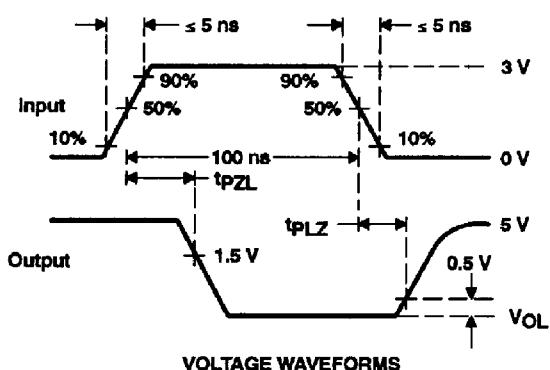
# SN75151, SN75153 QUAD DIFFERENTIAL LINE DRIVERS WITH 3-STATE OUTPUTS

SLLS082A - D2453, DECEMBER 1978 - REVISED FEBRUARY 1993

## PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE WAVEFORMS

- NOTES: A. The pulse generators have the following characteristics:  $Z_O = 50 \Omega$ , PRR  $\leq 500$  kHz.  
B.  $C_L$  includes probe and jig capacitance.

Figure 4. Test Circuit and Voltage Waveforms

SN75151, SN75153  
QUAD DIFFERENTIAL LINE DRIVERS WITH 3-STATE OUTPUTS

SLLS082A - D2453, DECEMBER 1978 - REVISED FEBRUARY 1993

**TYPICAL CHARACTERISTICS**

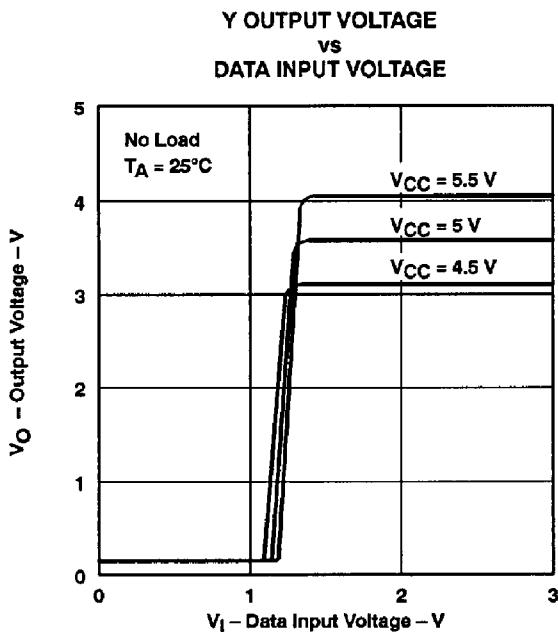
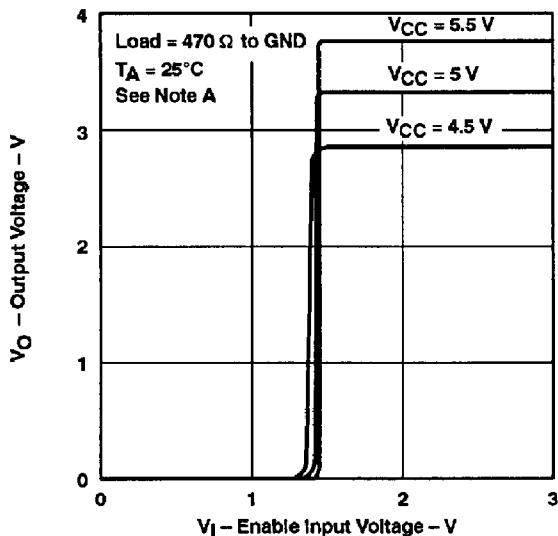


Figure 5

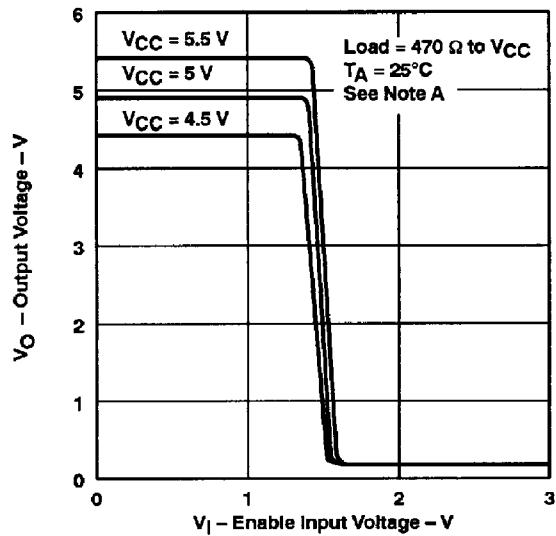
**Y OR Z OUTPUT VOLTAGE  
vs  
ENABLE INPUT VOLTAGE**



NOTE A: The A input is connected to  $V_{CC}$  during the testing of the Y outputs and to ground during testing of the Z outputs.

Figure 6

**Y OR Z OUTPUT VOLTAGE  
vs  
ENABLE INPUT VOLTAGE**



NOTE A: The A input is connected to GND during the testing of the Y outputs and to  $V_{CC}$  during the testing of the Z outputs.

Figure 7

**TEXAS  
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

# SN75151, SN75153 QUAD DIFFERENTIAL LINE DRIVERS WITH 3-STATE OUTPUTS

SLLS082A - D2453, DECEMBER 1978 - REVISED FEBRUARY 1993

## TYPICAL CHARACTERISTICS

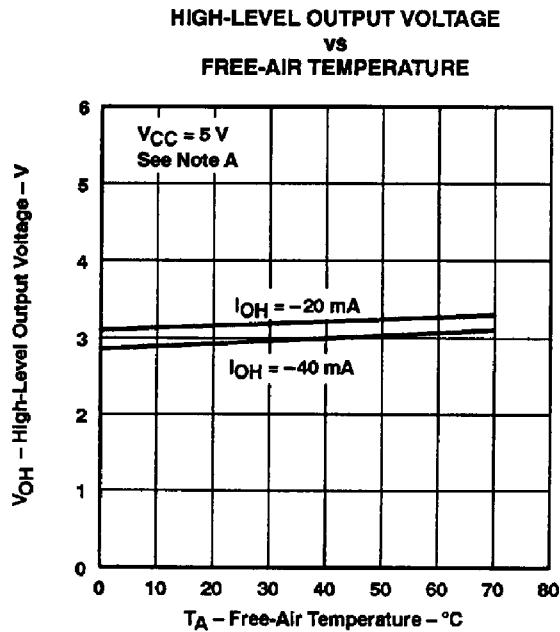


Figure 8

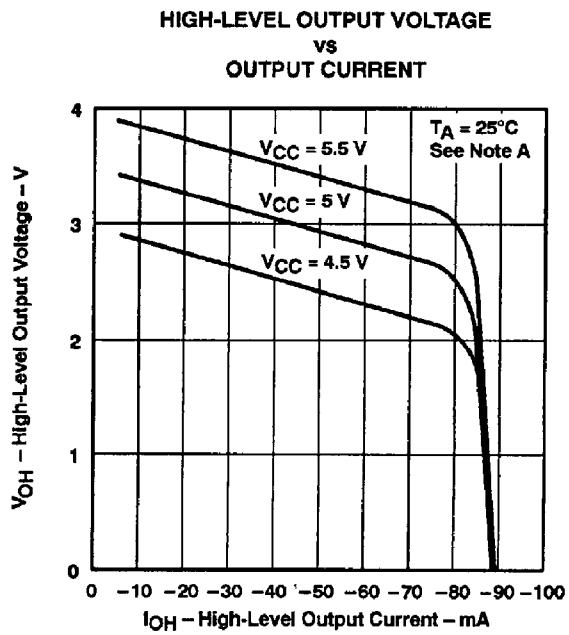


Figure 9

NOTE A: The A input is connected to  $V_{CC}$  during the testing of the Y outputs and to ground during testing of the Z outputs.

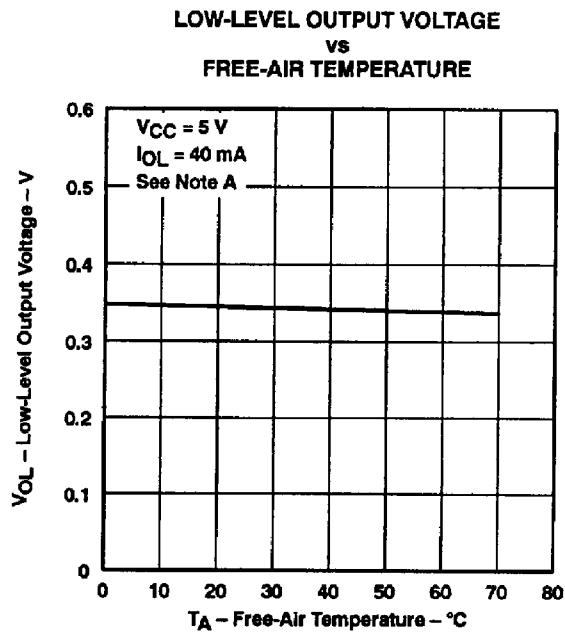


Figure 10

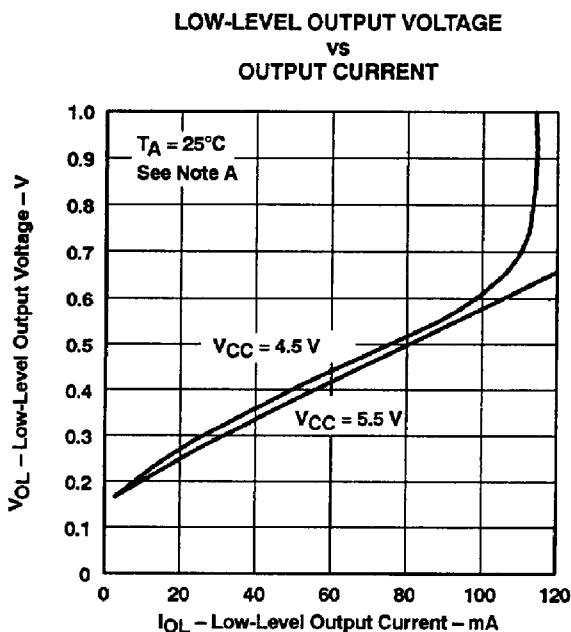


Figure 11

NOTE A: The A input is connected to GND during the testing of the Y outputs and to  $V_{CC}$  during the testing of the Z outputs.

**SN75151, SN75153**  
**QUAD DIFFERENTIAL LINE DRIVERS WITH 3-STATE OUTPUTS**

SLLS082A - D2453, DECEMBER 1978 - REVISED FEBRUARY 1993

**TYPICAL CHARACTERISTICS**

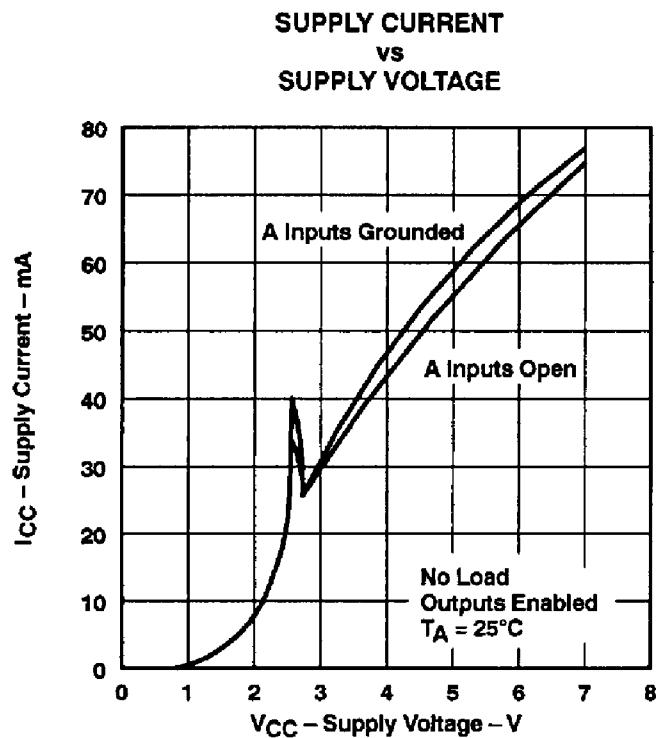


Figure 12

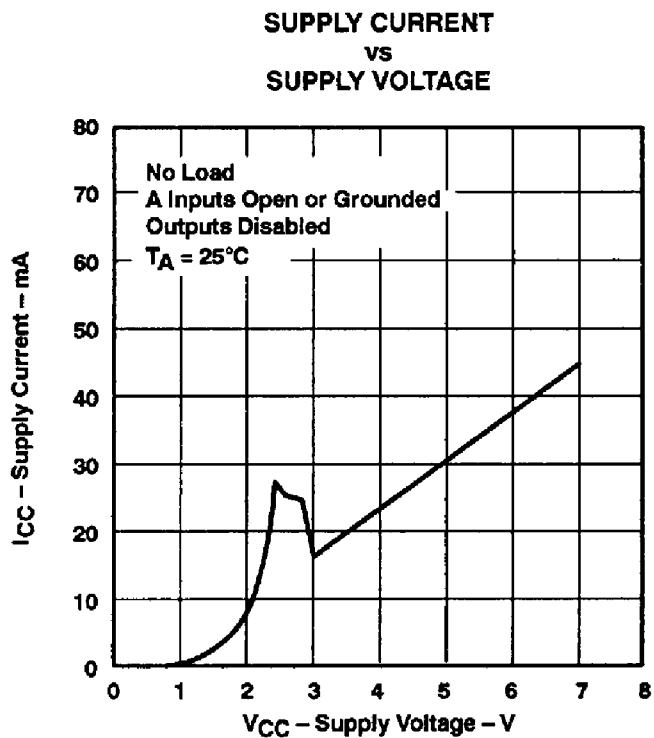


Figure 13