

# **SN54150, SN54151A, SN54LS151, SN54S151, SN74150, SN74151A, SN74LS151, SN74S151 DATA SELECTORS/MULTIPLEXERS**

DECEMBER 1972—REVISED MARCH 1988

- '150 Selects One-of-Sixteen Data Sources
- Others Select One-of-Eight Data Sources
- All Perform Parallel-to-Serial Conversion
- All Permit Multiplexing from N Lines to One Line
- Also For Use as Boolean Function Generator
- Input-Clamping Diodes Simplify System Design
- Fully Compatible with Most TTL Circuits

| TYPE   | TYPICAL AVERAGE<br>PROPAGATION DELAY TIME<br>DATA INPUT TO W OUTPUT | TYPICAL<br>POWER<br>DISSIPATION |
|--------|---------------------------------------------------------------------|---------------------------------|
| '150   | 13 ns                                                               | 200 mW                          |
| '151A  | 8 ns                                                                | 145 mW                          |
| 'LS151 | 13 ns                                                               | 30 mW                           |
| 'S151  | 4.5 ns                                                              | 225 mW                          |

## description

These monolithic data selectors/multiplexers contain full on-chip binary decoding to select the desired data source. The '150 selects one-of-sixteen data sources; the '151A, 'LS151, and 'S151 select one-of-eight data sources. The '150, '151A, 'LS151, and 'S151 have a strobe input which must be at a low logic level to enable these devices. A high level at the strobe forces the W output high, and the Y output (as applicable) low.

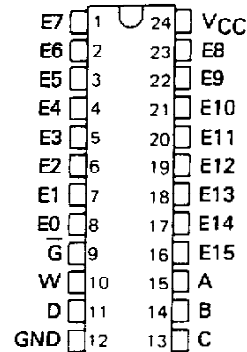
The '150 has only an inverted W output; the '151A, 'LS151, and 'S151 feature complementary W and Y outputs.

The '151A and '152A incorporate address buffers that have symmetrical propagation delay times through the complementary paths. This reduces the possibility of transients occurring at the output(s) due to changes made at the select inputs, even when the '151A outputs are enabled (i.e., strobe low).

### SN54150 . . . J OR W PACKAGE

#### SN74150 . . . N PACKAGE

(TOP VIEW)

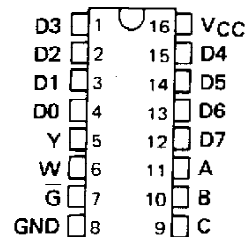


### SN54151A, SN54LS151, SN54S151 . . . J OR W PACKAGE

#### SN74151A . . . N PACKAGE

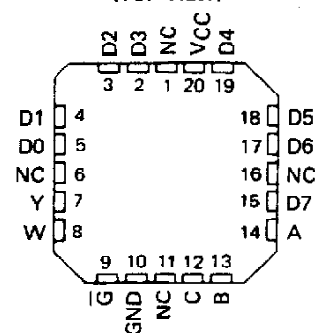
#### SN74LS151, SN74S151 . . . D OR N PACKAGE

(TOP VIEW)



### SN54LS151, SN54S151 . . . FK PACKAGE

(TOP VIEW)



NC - No internal connection

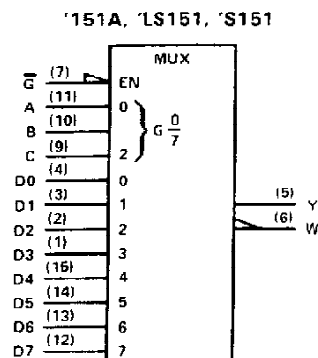
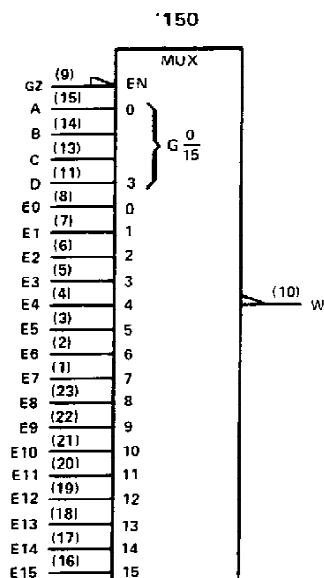
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**SN54150, SN54151A, SN54LS151, SN54S151,  
SN74150, SN74151A, SN74LS151, SN74S151  
DATA SELECTORS/MULTIPLEXERS**

logic symbols<sup>†</sup>



<sup>†</sup>These symbols are in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.  
Pin numbers shown are D, J, N, and W packages.

'150

FUNCTION TABLE

| INPUTS |   |   |   |           | STROBE      | OUTPUT |
|--------|---|---|---|-----------|-------------|--------|
| SELECT |   |   |   | $\bar{G}$ |             | W      |
| D      | C | B | A |           |             |        |
| X      | X | X | X | H         | H           |        |
| L      | L | L | L | L         | $\bar{E0}$  |        |
| L      | L | L | H | L         | $\bar{E1}$  |        |
| L      | L | H | L | L         | $\bar{E2}$  |        |
| L      | L | H | H | L         | $\bar{E3}$  |        |
| L      | H | L | L | L         | $\bar{E4}$  |        |
| L      | H | L | H | L         | $\bar{E5}$  |        |
| L      | H | H | L | L         | $\bar{E6}$  |        |
| L      | H | H | H | L         | $\bar{E7}$  |        |
| H      | L | L | L | L         | $\bar{E8}$  |        |
| H      | L | L | H | L         | $\bar{E9}$  |        |
| H      | L | H | L | L         | $\bar{E10}$ |        |
| H      | L | H | H | L         | $\bar{E11}$ |        |
| H      | H | L | L | L         | $\bar{E12}$ |        |
| H      | H | L | H | L         | $\bar{E13}$ |        |
| H      | H | H | L | L         | $\bar{E14}$ |        |
| H      | H | H | H | L         | $\bar{E15}$ |        |

**'151A, 'LS151, 'S151**

**FUNCTION TABLE**

| INPUTS |           |  |  | OUTPUTS |            |
|--------|-----------|--|--|---------|------------|
| SELECT | STROBE    |  |  | Y       | W          |
| C B A  | $\bar{G}$ |  |  |         |            |
| X X X  | H         |  |  | L       | H          |
| L L L  | L         |  |  | D0      | $\bar{D0}$ |
| L L H  | L         |  |  | D1      | $\bar{D1}$ |
| L H L  | L         |  |  | D2      | $\bar{D2}$ |
| L H H  | L         |  |  | D3      | $\bar{D3}$ |
| H L L  | L         |  |  | D4      | $\bar{D4}$ |
| H L H  | L         |  |  | D5      | $\bar{D5}$ |
| H H L  | L         |  |  | D6      | $\bar{D6}$ |
| H H H  | L         |  |  | D7      | $\bar{D7}$ |

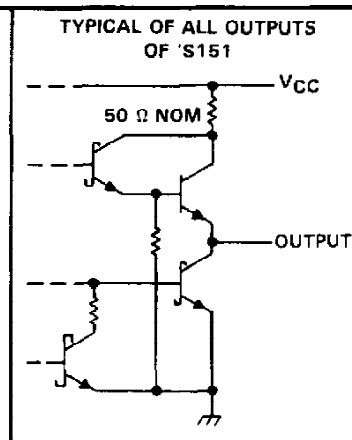
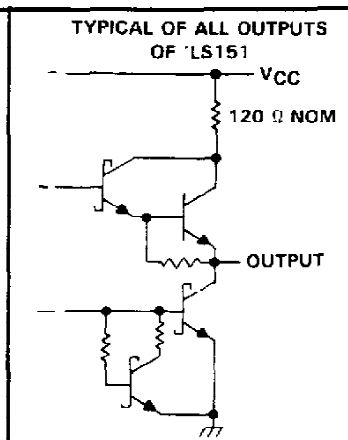
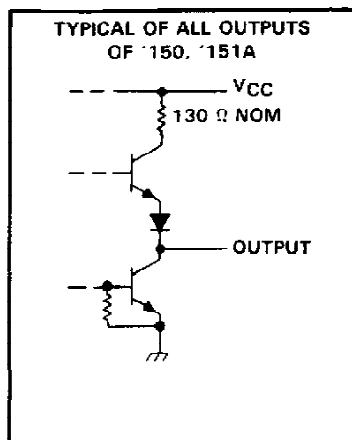
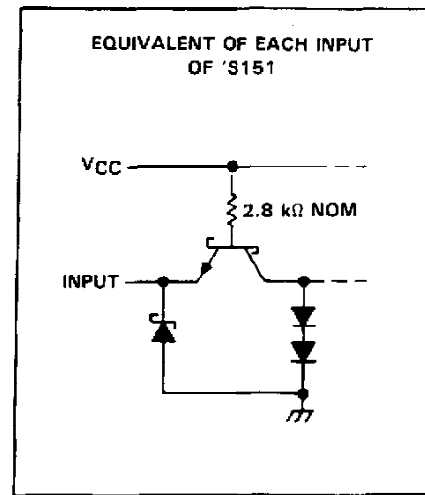
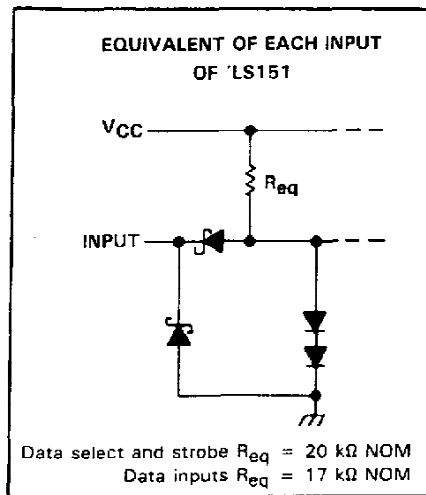
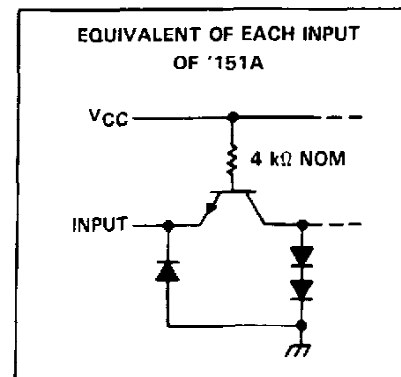
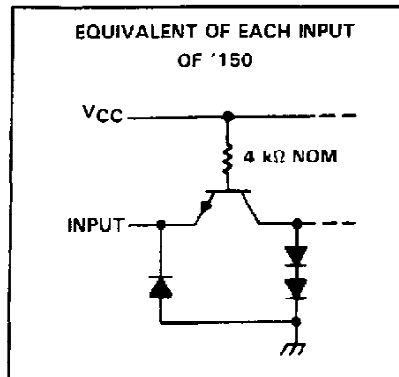
H = high level, L = low level, X = irrelevant  
 $\bar{E0}, \bar{E1} \dots \bar{E15}$  = the complement of the level of the respective E input  
D0, D1 ... D7 = the level of the D respective input

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**SN54150, SN54151A, SN54LS151, SN54S151  
SN74150, SN74151A, SN74LS151, SN74S151  
DATA SELECTORS/MULTIPLEXERS**

schematics of inputs and outputs



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# SN54150, SN54151A, SN74150, SN74151A

## DATA SELECTORS/MULTIPLEXERS

### recommended operating conditions

|                                       | SN54' |     |      | SN74' |     |      | UNIT         |
|---------------------------------------|-------|-----|------|-------|-----|------|--------------|
|                                       | MIN   | NOM | MAX  | MIN   | NOM | MAX  |              |
| Supply voltage, $V_{CC}$              | 4.5   | 5   | 5.5  | 4.75  | 5   | 5.25 | V            |
| High-level output current, $I_{OH}$   |       |     | -800 |       |     | -800 | $\mu$ A      |
| Low-level output current, $I_{OL}$    |       |     | 16   |       |     | 16   | mA           |
| Operating free-air temperature, $T_A$ | -55   |     | 125  | 0     |     | 70   | $^{\circ}$ C |

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

| PARAMETER                                          | TEST CONDITIONS <sup>†</sup>                                                                                | '150  |                  |      | '151A |                  |      | UNIT    |
|----------------------------------------------------|-------------------------------------------------------------------------------------------------------------|-------|------------------|------|-------|------------------|------|---------|
|                                                    |                                                                                                             | MIN   | TYP <sup>‡</sup> | MAX  | MIN   | TYP <sup>‡</sup> | MAX  |         |
| $V_{IH}$ High-level input voltage                  |                                                                                                             | 2     |                  |      | 2     |                  |      | V       |
| $V_{IL}$ Low-level input voltage                   |                                                                                                             |       |                  | 0.8  |       |                  | 0.8  | V       |
| $V_{IK}$ Input clamp voltage                       | $V_{CC} = \text{MIN.}$ , $I_I = -8 \text{ mA}$                                                              |       |                  | -1.5 |       |                  | -1.5 | V       |
| $V_{OH}$ High-level output voltage                 | $V_{CC} = \text{MIN.}$ , $V_{IH} = 2 \text{ V}$ ,<br>$V_{IL} = 0.8 \text{ V}$ , $I_{OH} = -800 \mu\text{A}$ | 2.4   | 3.4              |      | 2.4   | 3.4              |      | V       |
| $V_{OL}$ Low-level output voltage                  | $V_{CC} = \text{MIN.}$ , $V_{IH} = 2 \text{ V}$ ,<br>$V_{IL} = 0.8 \text{ V}$ , $I_{OL} = 16 \text{ mA}$    |       | 0.2              | 0.4  |       | 0.2              | 0.4  | V       |
| $I_I$ Input current at maximum input voltage       | $V_{CC} = \text{MAX.}$ , $V_I = 5.5 \text{ V}$                                                              |       |                  | 1    |       |                  | 1    | mA      |
| $I_{IH}$ High-level input current                  | $V_{CC} = \text{MAX.}$ , $V_I = 2.4 \text{ V}$                                                              |       |                  | 40   |       |                  | 40   | $\mu$ A |
| $I_{IL}$ Low-level input current                   | $V_{CC} = \text{MAX.}$ , $V_I = 0.4 \text{ V}$                                                              |       |                  | -1.6 |       |                  | -1.6 | mA      |
| $I_{OS}$ Short-circuit output current <sup>§</sup> | $V_{CC} = \text{MAX.}$                                                                                      | SN54' | -20              | -55  | -20   | -55              |      | mA      |
|                                                    |                                                                                                             | SN74' | -18              | -55  | -18   | -55              |      |         |
| $I_{CC}$ Supply current                            | $V_{CC} = \text{MAX.}$ See Note 3                                                                           |       | 40               | 68   |       | 29               | 48   | mA      |

<sup>†</sup> For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable device type.

<sup>‡</sup> All typical values at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^{\circ}\text{C}$ .

<sup>§</sup> Not more than one output of the '151A should be shorted at a time.

NOTE 3:  $I_{CC}$  is measured with the strobe and data select inputs at 4.5 V, all other inputs and outputs open.

### switching characteristics, $V_{CC} = 5 \text{ V}$ , $T_A = 25^{\circ}\text{C}$

| PARAMETER <sup>¶</sup> | FROM<br>(INPUT)               | TO<br>(OUTPUT) | TEST<br>CONDITIONS                                                 | '150 |     |     | '151A |     |     | UNIT |
|------------------------|-------------------------------|----------------|--------------------------------------------------------------------|------|-----|-----|-------|-----|-----|------|
|                        |                               |                |                                                                    | MIN  | TYP | MAX | MIN   | TYP | MAX |      |
| t <sub>PLH</sub>       | A, B, or C<br>(4 levels)      | Y              | C <sub>L</sub> = 15 pF,<br>R <sub>L</sub> = 400 Ω,<br>See Note 4 i |      |     |     | 25    | 38  | ns  |      |
| t <sub>PHL</sub>       |                               |                |                                                                    |      |     |     | 25    | 38  |     |      |
| t <sub>PLH</sub>       | A, B, C, or D<br>(3 levels)   | W              |                                                                    | 23   | 35  | 17  | 26    | ns  |     |      |
| t <sub>PHL</sub>       |                               |                |                                                                    | 22   | 33  | 19  | 30    |     |     |      |
| t <sub>PLH</sub>       | Strobe $\overline{G}$         | Y              |                                                                    |      |     | 21  | 33    | ns  |     |      |
| t <sub>PHL</sub>       |                               |                |                                                                    |      |     | 22  | 33    |     |     |      |
| t <sub>PLH</sub>       | Strobe $\overline{G}$         | W              |                                                                    | 15.5 | 24  | 14  | 21    | ns  |     |      |
| t <sub>PHL</sub>       |                               |                |                                                                    | 21   | 30  | 15  | 23    |     |     |      |
| t <sub>PLH</sub>       | D0 thru D7                    | Y              |                                                                    |      |     | 13  | 20    | ns  |     |      |
| t <sub>PHL</sub>       |                               |                |                                                                    |      |     | 18  | 27    |     |     |      |
| t <sub>PLH</sub>       | E0 thru E15, or<br>D0 thru D7 | W              | 8.5                                                                | 14   | 8   | 14  | ns    |     |     |      |
| t <sub>PHL</sub>       |                               |                | 13                                                                 | 20   | 8   | 14  |       |     |     |      |

<sup>¶</sup>  $t_{PLH}$  = propagation delay time, low-to-high-level output

$t_{PHL}$  = propagation delay time, high-to-low-level output

NOTE 4: Load circuits and voltage waveforms are shown in Section 1.

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# SN54LS151, SN74LS151

## DATA SELECTORS/MULTIPLEXERS

### recommended operating conditions

|                                       | SN54LS151 |     |      | SN74LS151 |     |      | UNIT        |
|---------------------------------------|-----------|-----|------|-----------|-----|------|-------------|
|                                       | MIN       | NOM | MAX  | MIN       | NOM | MAX  |             |
| Supply voltage, $V_{CC}$              | 4.5       | 5   | 5.5  | 4.75      | 5   | 5.25 | V           |
| High-level output current, $I_{OH}$   |           |     | -400 |           |     | -400 | $\mu A$     |
| Low-level output current, $I_{OL}$    |           |     | 4    |           |     | 8    | mA          |
| Operating free-air temperature, $T_A$ | -55       |     | 125  | 0         |     | 70   | $^{\circ}C$ |

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

| PARAMETER                                             | TEST CONDITIONS†                                                                                                  | SN54LS151              |      |      | SN74LS151 |      |      | UNIT |
|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|------------------------|------|------|-----------|------|------|------|
|                                                       |                                                                                                                   | MIN                    | TYP‡ | MAX  | MIN       | TYP‡ | MAX  |      |
| V <sub>IH</sub> High-level input voltage              |                                                                                                                   | 2                      |      |      | 2         |      |      | V    |
| V <sub>IL</sub> Low-level input voltage               |                                                                                                                   |                        |      | 0.7  |           |      | 0.8  | V    |
| V <sub>IK</sub> Input clamp voltage                   | V <sub>CC</sub> = MIN, I <sub>I</sub> = -18 mA                                                                    |                        |      | -1.5 |           |      | -1.5 | V    |
| V <sub>OH</sub> High-level output voltage             | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V,<br>V <sub>IL</sub> = V <sub>ILmax</sub> , I <sub>OH</sub> = -400 μA | 2.5                    | 3.4  |      | 2.7       | 3.4  |      | V    |
| V <sub>OL</sub> Low-level output voltage              | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V,<br>V <sub>IL</sub> = V <sub>ILmax</sub>                             | I <sub>OL</sub> = 4 mA |      | 0.25 | 0.4       | 0.25 | 0.4  | V    |
|                                                       |                                                                                                                   | I <sub>OL</sub> = 8 mA |      |      |           | 0.35 | 0.5  |      |
| I <sub>I</sub> Input current at maximum input voltage | V <sub>CC</sub> = MAX, V <sub>I</sub> = 7 V                                                                       |                        |      | 0.1  |           |      | 0.1  | mA   |
| I <sub>IH</sub> High-level input current              | V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V                                                                     |                        |      | 20   |           |      | 20   | μA   |
| I <sub>IL</sub> Low-level input current               | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V                                                                     |                        |      | -0.4 |           |      | -0.4 | mA   |
| I <sub>OS</sub> Short-circuit output current§         | V <sub>CC</sub> = MAX                                                                                             | -20                    |      | -100 | -20       |      | -100 | mA   |
| I <sub>CC</sub> Supply current                        | V <sub>CC</sub> = MAX, Outputs open,<br>All inputs at 4.5 V                                                       |                        | 6.0  | 10   |           | 6.0  | 10   | mA   |

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

‡ All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^{\circ}C$ .

§ Not more than one output should be shorted at a time and duration of short-circuit should not exceed one second.

### switching characteristics, $V_{CC} = 5 \text{ V}$ , $T_A = 25^{\circ}C$

| PARAMETER† | FROM<br>(INPUT)          | TO<br>(OUTPUT) | TEST CONDITIONS                         | MIN | TYP | MAX | UNIT |
|------------|--------------------------|----------------|-----------------------------------------|-----|-----|-----|------|
| tPLH       | A, B, or C<br>(4 levels) | Y              | CL = 15 pF,<br>RL = 2 kΩ,<br>See Note 4 |     | 27  | 43  | ns   |
| tPHL       |                          |                |                                         |     | 18  | 30  |      |
| tPLH       | A, B, or C<br>(3 levels) | W              |                                         |     | 14  | 23  | ns   |
| tPHL       |                          |                |                                         |     | 20  | 32  |      |
| tPLH       | Strobe $\overline{G}$    | Y              |                                         |     | 26  | 42  | ns   |
| tPHL       |                          |                |                                         |     | 20  | 32  |      |
| tPLH       | Strobe $\overline{G}$    | W              |                                         |     | 15  | 24  | ns   |
| tPHL       |                          |                |                                         |     | 18  | 30  |      |
| tPLH       | Any D                    | Y              |                                         |     | 20  | 32  | ns   |
| tPHL       |                          |                |                                         |     | 16  | 26  |      |
| tPLH       | Any D                    | W              |                                         |     | 13  | 21  | ns   |
| tPHL       |                          |                |                                         |     | 12  | 20  |      |

†  $t_{PLH}$  = propagation delay time, low-to-high-level output

$t_{PHL}$  = propagation delay time, high-to-low-level output

NOTE 4: Load circuits and voltage waveforms are shown in Section 1.

TEXAS  
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# SN54S151, SN74S151

## DATA SELECTORS/MULTIPLEXERS

### recommended operating conditions

|                                       | SN54S151 |     |     | SN74S151 |     |      | UNIT |
|---------------------------------------|----------|-----|-----|----------|-----|------|------|
|                                       | MIN      | NOM | MAX | MIN      | NOM | MAX  |      |
| Supply voltage, $V_{CC}$              | 4.5      | 5   | 5.5 | 4.75     | 5   | 5.25 | V    |
| High-level output current, $I_{OH}$   |          |     | -1  |          |     | -1   | mA   |
| Low-level output current, $I_{OL}$    |          |     | 20  |          |     | 20   | mA   |
| Operating free-air temperature, $T_A$ | -55      |     | 125 | 0        |     | 70   | °C   |

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

| PARAMETER                                    | TEST CONDITIONS†                                                                                        | MIN      | TYP‡ | MAX  | UNIT |
|----------------------------------------------|---------------------------------------------------------------------------------------------------------|----------|------|------|------|
| $V_{IH}$ High-level input voltage            |                                                                                                         | 2        |      |      | V    |
| $V_{IL}$ Low-level input voltage             |                                                                                                         |          |      | 0.8  | V    |
| $V_{IK}$ Input clamp voltage                 | $V_{CC} = \text{MIN}$ , $I_I = -18 \text{ mA}$                                                          |          |      | -1.2 | V    |
| $V_{OH}$ High-level output voltage           | $V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ ,<br>$V_{IL} = 0.8 \text{ V}$ , $I_{OH} = -1 \text{ mA}$ | SN54S151 | 2.5  | 3.4  | V    |
|                                              |                                                                                                         | SN74S151 | 2.7  | 3.4  |      |
| $V_{OL}$ Low-level output voltage            | $V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ ,<br>$V_{IL} = 0.8 \text{ V}$ , $I_{OL} = 20 \text{ mA}$ |          |      | 0.5  | V    |
|                                              |                                                                                                         |          |      |      |      |
| $I_I$ Input current at maximum input voltage | $V_{CC} = \text{MAX}$ , $V_I = 5.5 \text{ V}$                                                           |          |      | 1    | mA   |
| $I_{IH}$ High-level input current            | $V_{CC} = \text{MAX}$ , $V_I = 2.7 \text{ V}$                                                           |          |      | 50   | µA   |
| $I_{IL}$ Low-level input current             | $V_{CC} = \text{MAX}$ , $V_I = 0.5 \text{ V}$                                                           |          |      | -2   | mA   |
| $I_{OS}$ Short-circuit output current§       | $V_{CC} = \text{MAX}$                                                                                   | -40      |      | -100 | mA   |
| $I_{CC}$ Supply current                      | $V_{CC} = \text{MAX}$ , All inputs at 4.5 V,<br>All outputs open                                        |          | 45   | 70   | mA   |

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

‡ All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^\circ \text{C}$ .

§ Not more than one output should be shorted at a time, and duration of the short-circuit should not exceed one second.

### switching characteristics, $V_{CC} = 5 \text{ V}$ , $T_A = 25^\circ \text{C}$

| PARAMETER† | FROM<br>(INPUT)          | TO<br>(OUTPUT) | TEST CONDITIONS                           | MIN | TYP | MAX  | UNIT |
|------------|--------------------------|----------------|-------------------------------------------|-----|-----|------|------|
| tPLH       | A, B, or C<br>(4 levels) | Y              | CL = 15 pF,<br>RL = 280 kΩ,<br>See Note 4 |     | 12  | 18   | ns   |
| tPHL       |                          |                |                                           |     | 12  | 18   |      |
| tPLH       | A, B, or C<br>(3 levels) | W              |                                           |     | 10  | 15   | ns   |
| tPHL       |                          |                |                                           |     | 9   | 13.5 |      |
| tPLH       | Any D                    | Y              |                                           |     | 8   | 12   | ns   |
| tPHL       |                          |                |                                           |     | 8   | 12   |      |
| tPLH       | Any D                    | W              |                                           |     | 4.5 | 7    | ns   |
| tPHL       |                          |                |                                           |     | 4.5 | 7    |      |
| tPLH       | Strobe $\overline{G}$    | Y              |                                           |     | 11  | 16.5 | ns   |
| tPHL       |                          |                |                                           |     | 12  | 18   |      |
| tPLH       | Strobe $\overline{G}$    | W              |                                           |     | 9   | 13   | ns   |
| tPHL       |                          |                |                                           |     | 8.5 | 12   |      |

†  $t_{PLH}$  = propagation delay time, low-to-high-level output

$t_{PHL}$  = propagation delay time, high-to-low-level output

NOTE 4: Load circuits and voltage waveforms are shown in Section 1.



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