- **3-State Version of 'HC151**
- **High-Current 3-State Outputs Interface Directly With System Bus or Can Drive up to 15 LSTTL Loads**
- **Perform Parallel-to-Serial Conversion**
- **Complementary Outputs Provide True and Inverted Data**
- **Package Options Include Plastic Small-Outline (D), Shrink Small-Outline (DB), and Ceramic Flat (W) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) DIPs**

**SN54HC251 . . . J OR W PACKAGE**
**SN74HC251 . . . D, DB, OR N PACKAGE**
**(TOP VIEW)**

| | | | |
|---|---|---|---|
| D3 | 1 | 16 | $V_{CC}$ |
| D2 | 2 | 15 | D4 |
| D1 | 3 | 14 | D5 |
| D0 | 4 | 13 | D6 |
| Y | 5 | 12 | D7 |
| W | 6 | 11 | A |
| $\overline{OE}$ | 7 | 10 | B |
| GND | 8 | 9 | C |

**SN54HC251 . . . FK PACKAGE**
**(TOP VIEW)**

Top row: D2, D3, NC, $V_{CC}$, D4

| | | | |
|---|---|---|---|
| D1 | 4 | 18 | D5 |
| D0 | 5 | 17 | D6 |
| NC | 6 | 16 | NC |
| Y | 7 | 15 | D7 |
| W | 8 | 14 | A |

Bottom row: $\overline{OE}$, GND, NC, C, B

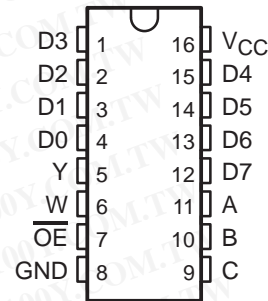NC – No internal connection

## description

These data selectors/multiplexers contain full binary decoding to select 1-of-8 data sources and feature strobe-controlled complementary 3-state outputs.
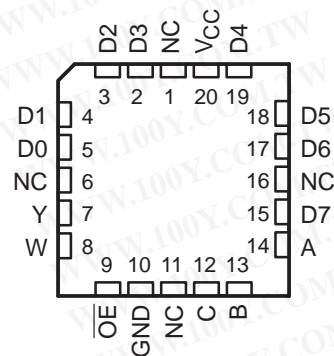
The 3-state outputs can interface with and drive data lines of bus-organized systems. With all but one of the common outputs disabled (in the high-impedance state), the low impedance of the single enabled output drives the bus line to a high or low logic level. Both outputs are controlled by the output-enable ($\overline{OE}$) input. The outputs are disabled when $\overline{OE}$ is high.

The SN54HC251 is characterized for operation over the full military temperature range of –55°C to 125°C. The SN74HC251 is characterized for operation from –40°C to 85 °C.

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**TEXAS INSTRUMENTS**

**FUNCTION TABLE**

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

D0, D1 . . . D7 = the level of the respective D input

## logic symbol†
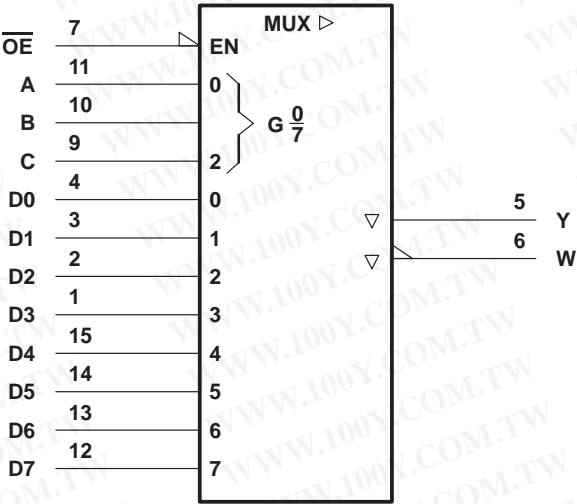


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.
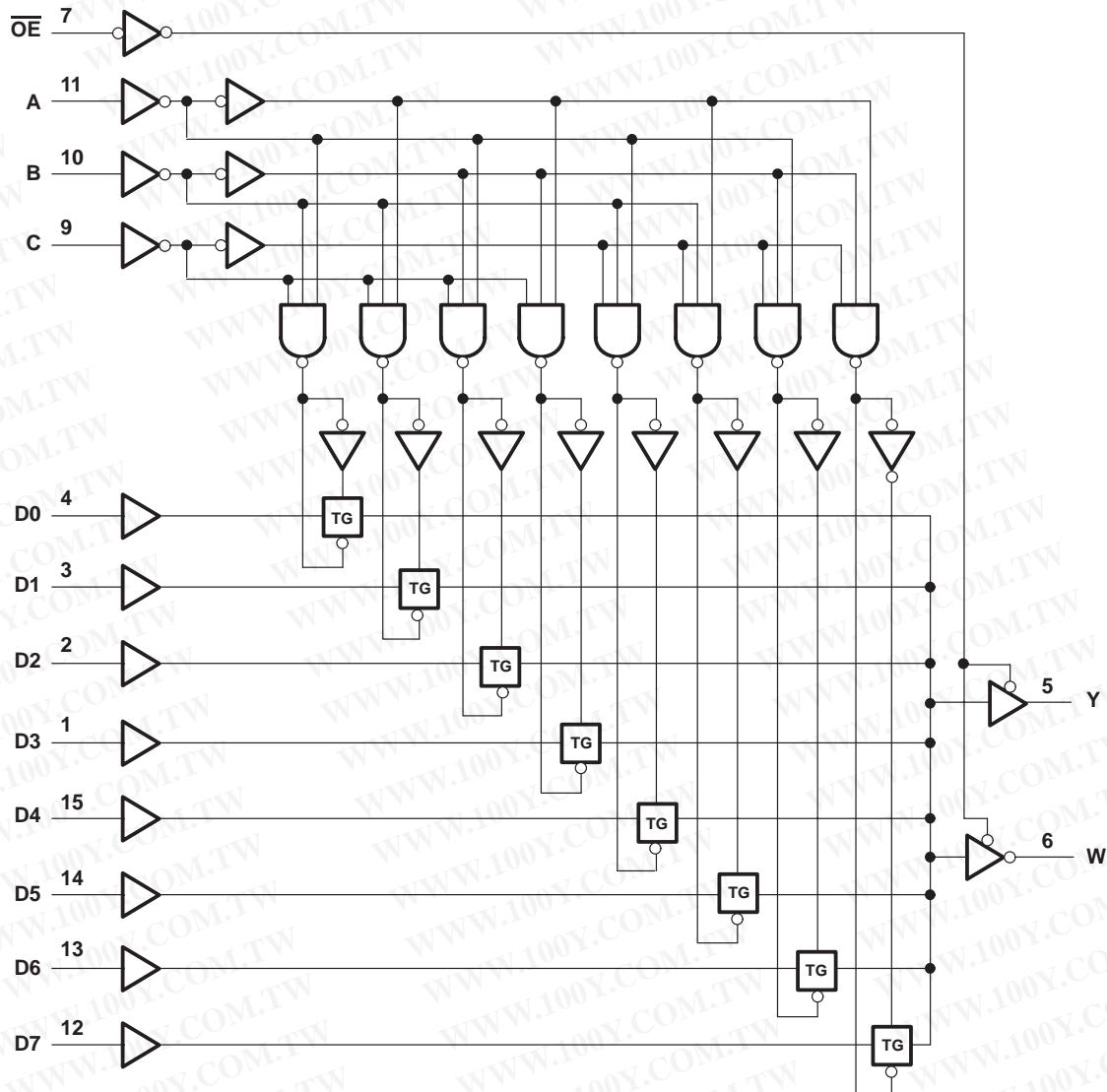Pin numbers shown are for the D, DB, J, N, and W packages.

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**logic diagram (positive logic)**



Pin numbers shown are for the D, DB, J, N, and W packages.

## absolute maximum ratings over operating free-air temperature range[†]

Supply voltage range, $V_{CC}$ ........................................................ −0.5 V to 7 V
Input clamp current, $I_{IK}$ ($V_I < 0$ or $V_I > V_{CC}$) (see Note 1) .................................. ±20 mA
Output clamp current, $I_{OK}$ ($V_O < 0$ or $V_O > V_{CC}$) (see Note 1) ............................. ±20 mA
Continuous output current, $I_O$ ($V_O = 0$ to $V_{CC}$) ........................................ ±35 mA
Continuous current through $V_{CC}$ or GND ............................................. ±70 mA
Package thermal impedance, $\theta_{JA}$ (see Note 2): D package .................................. 113°C/W
                                                           DB package ......................... 131°C/W
                                                           N package ................................ 78°C/W
Storage temperature range, $T_{stg}$ ................................................. −65°C to 150°C

[†] Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
        2. The package thermal impedance is calculated in accordance with JESD 51, except for through-hole packages, which use a trace length of zero.

## recommended operating conditions (see Note 3)

| | | | SN54HC251 | | | SN74HC251 | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | MIN | NOM | MAX | MIN | NOM | MAX | |
| $V_{CC}$ | Supply voltage | | 2 | 5 | 6 | 2 | 5 | 6 | V |
| $V_{IH}$ | High-level input voltage | $V_{CC} = 2$ V | 1.5 | | | 1.5 | | | V |
| | | $V_{CC} = 4.5$ V | 3.15 | | | 3.15 | | | |
| | | $V_{CC} = 6$ V | 4.2 | | | 4.2 | | | |
| $V_{IL}$ | Low-level input voltage | $V_{CC} = 2$ V | 0 | | 0.5 | 0 | | 0.5 | V |
| | | $V_{CC} = 4.5$ V | 0 | | 1.35 | 0 | | 1.35 | |
| | | $V_{CC} = 6$ V | 0 | | 1.8 | 0 | | 1.8 | |
| $V_I$ | Input voltage | | 0 | | $V_{CC}$ | 0 | | $V_{CC}$ | V |
| $V_O$ | Output voltage | | 0 | | $V_{CC}$ | 0 | | $V_{CC}$ | V |
| $t_t$ | Input transition (rise and fall) time | $V_{CC} = 2$ V | 0 | | 1000 | 0 | | 1000 | ns |
| | | $V_{CC} = 4.5$ V | 0 | | 500 | 0 | | 500 | |
| | | $V_{CC} = 6$ V | 0 | | 400 | 0 | | 400 | |
| $T_A$ | Operating free-air temperature | | −55 | | 125 | −40 | | 85 | °C |

NOTE 3: All unused inputs of the device must be held at $V_{CC}$ or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

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

| PARAMETER | TEST CONDITIONS | | $V_{CC}$ | $T_A = 25°C$ | | | SN54HC251 | | SN74HC251 | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| $V_{OH}$ | $V_I = V_{IH}$ or $V_{IL}$ | $I_{OH} = -20\ \mu A$ | 2 V | 1.9 | 1.998 | | 1.9 | | 1.9 | | V |
| | | | 4.5 V | 4.4 | 4.499 | | 4.4 | | 4.4 | | |
| | | | 6 V | 5.9 | 5.999 | | 5.9 | | 5.9 | | |
| | | $I_{OH} = -6\ mA$ | 4.5 V | 3.98 | 4.3 | | 3.7 | | 3.84 | | |
| | | $I_{OH} = -7.8\ mA$ | 6 V | 5.48 | 5.8 | | 5.2 | | 5.34 | | |
| $V_{OL}$ | $V_I = V_{IH}$ or $V_{IL}$ | $I_{OL} = 20\ \mu A$ | 2 V | | 0.002 | 0.1 | | 0.1 | | 0.1 | V |
| | | | 4.5 V | | 0.001 | 0.1 | | 0.1 | | 0.1 | |
| | | | 6 V | | 0.001 | 0.1 | | 0.1 | | 0.1 | |
| | | $I_{OL} = 6\ mA$ | 4.5 V | | 0.17 | 0.26 | | 0.4 | | 0.33 | |
| | | $I_{OL} = 7.8\ mA$ | 6 V | | 0.15 | 0.26 | | 0.4 | | 0.33 | |
| $I_I$ | $V_I = V_{CC}$ or 0 | | 6 V | | ±0.1 | ±100 | | ±1000 | | ±1000 | nA |
| $I_{OZ}$ | $V_O = V_{CC}$ or 0, $V_I = V_{IH}$ or $V_{IL}$ | | 6 V | | ±0.01 | ±0.5 | | ±10 | | ±5 | μA |
| $I_{CC}$ | $V_I = V_{CC}$ or 0, $I_O = 0$ | | 6 V | | | 8 | | 160 | | 80 | μA |
| $C_i$ | | | 2 V to 6 V | | 3 | 10 | | 10 | | 10 | pF |

**switching characteristics over recommended operating free-air temperature range, $C_L = 50\ pF$ (unless otherwise noted) (see Figure 1)**

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $V_{CC}$ | $T_A = 25°C$ | | | SN54HC251 | | SN74HC251 | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| $t_{pd}$ | A, B, or C | W or Y | 2 V | | 58 | 205 | | 300 | | 256 | ns |
| | | | 4.5 V | | 21 | 41 | | 60 | | 51 | |
| | | | 6 V | | 19 | 35 | | 51 | | 44 | |
| | Any D | W or Y | 2 V | | 44 | 195 | | 283 | | 244 | |
| | | | 4.5 V | | 17 | 39 | | 57 | | 49 | |
| | | | 6 V | | 15 | 33 | | 48 | | 41 | |
| $t_{en}$ | $\overline{OE}$ | W or Y | 2 V | | 30 | 145 | | 210 | | 181 | ns |
| | | | 4.5 V | | 10 | 29 | | 42 | | 36 | |
| | | | 6 V | | 9 | 25 | | 36 | | 31 | |
| $t_{dis}$ | $\overline{OE}$ | W or Y | 2 V | | 25 | 195 | | 283 | | 244 | ns |
| | | | 4.5 V | | 15 | 39 | | 57 | | 49 | |
| | | | 6 V | | 14 | 33 | | 48 | | 41 | |
| $t_t$ | | W or Y | 2 V | | 20 | 75 | | 110 | | 95 | ns |
| | | | 4.5 V | | 8 | 15 | | 22 | | 19 | |
| | | | 6 V | | 6 | 13 | | 19 | | 16 | |

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# SN54HC251, SN74HC251
## DATA SELECTORS/MULTIPLEXERS
## WITH 3-STATE OUTPUTS

## switching characteristics over recommended operating free-air temperature range, $C_L$ = 150 pF (unless otherwise noted) (see Figure 1)

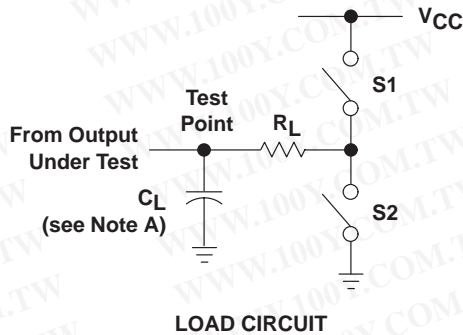| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $V_{CC}$ | $T_A = 25°C$ MIN | $T_A = 25°C$ TYP | $T_A = 25°C$ MAX | SN54HC251 MIN | SN54HC251 MAX | SN74HC251 MIN | SN74HC251 MAX | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $t_{pd}$ | A, B, or C | W or Y | 2 V | | 72 | 300 | | 450 | | 375 | ns |
| | | | 4.5 V | | 25 | 60 | | 90 | | 75 | |
| | | | 6 V | | 22 | 52 | | 77 | | 65 | |
| | Any D | W or Y | 2 V | | 59 | 300 | | 450 | | 375 | |
| | | | 4.5 V | | 21 | 60 | | 90 | | 75 | |
| | | | 6 V | | 18 | 52 | | 77 | | 65 | |
| $t_{en}$ | $\overline{OE}$ | W or Y | 2 V | | 50 | 230 | | 340 | | 285 | ns |
| | | | 4.5 V | | 17 | 46 | | 68 | | 57 | |
| | | | 6 V | | 15 | 40 | | 58 | | 50 | |
| $t_t$ | | W or Y | 2 V | | 45 | 210 | | 315 | | 265 | ns |
| | | | 4.5 V | | 17 | 42 | | 63 | | 53 | |
| | | | 6 V | | 13 | 36 | | 53 | | 45 | |

## operating characteristics, $T_A = 25°C$

| PARAMETER | TEST CONDITIONS | TYP | UNIT |
|---|---|---|---|
| $C_{pd}$    Power dissipation capacitance | No load | 70 | pF |

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## PARAMETER MEASUREMENT INFORMATION

**LOAD CIRCUIT**

| PARAMETER | | $R_L$ | $C_L$ | S1 | S2 |
|---|---|---|---|---|---|
| $t_{en}$ | $t_{PZH}$ | 1 kΩ | 50 pF or 150 pF | Open | Closed |
| | $t_{PZL}$ | | | Closed | Open |
| $t_{dis}$ | $t_{PHZ}$ | 1 kΩ | 50 pF | Open | Closed |
| | $t_{PLZ}$ | | | Closed | Open |
| $t_{pd}$ or $t_t$ | | — | 50 pF or 150 pF | Open | Open |

**VOLTAGE WAVEFORMS**
**PROPAGATION DELAY AND OUTPUT TRANSITION TIMES**

**VOLTAGE WAVEFORM**
**INPUT RISE AND FALL TIMES**

**VOLTAGE WAVEFORMS**
**ENABLE AND DISABLE TIMES FOR 3-STATE OUTPUTS**
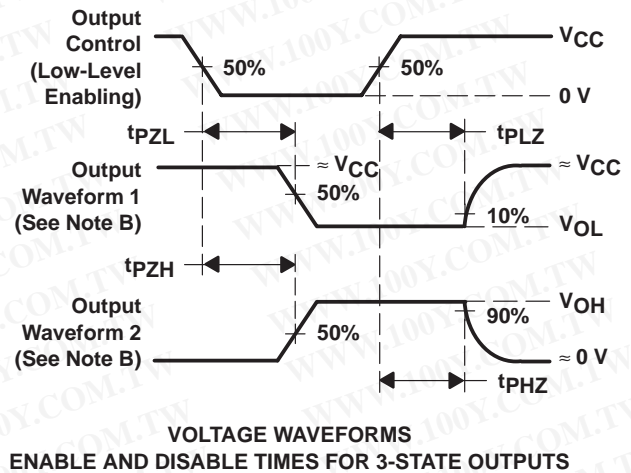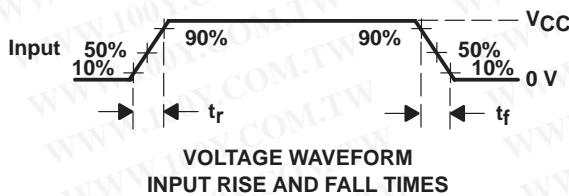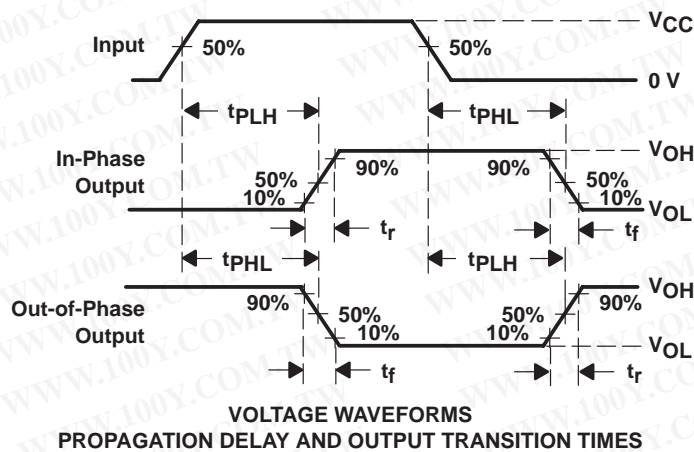
NOTES: A. $C_L$ includes probe and test-fixture capacitance.
B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control.
Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
C. Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, $Z_O$ = 50 Ω, $t_r$ = 6 ns, $t_f$ = 6 ns.
D. The outputs are measured one at a time with one input transition per measurement.
E. $t_{PLZ}$ and $t_{PHZ}$ are the same as $t_{dis}$.
F. $t_{PZL}$ and $t_{PZH}$ are the same as $t_{en}$.
G. $t_{PLH}$ and $t_{PHL}$ are the same as $t_{pd}$.

**Figure 1. Load Circuit and Voltage Waveforms**

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