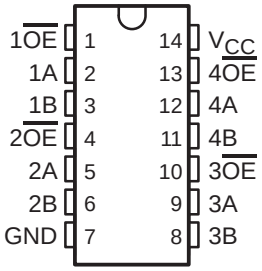
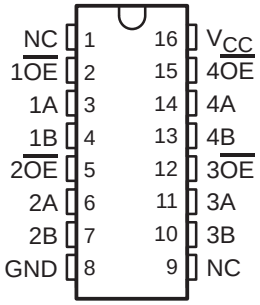
SCDS037E – DECEMBER 1997 – REVISED MAY 2000

- **Standard ’125-Type Pinout**
- **5-Ω Switch Connection Between Two Ports**
- **Isolation Under Power-Off Conditions**
- **Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II**
- **Package Options Include Plastic Small-Outline (D), Shrink Small-Outline (DBQ), Thin Very Small-Outline (DGV), and Thin Shrink Small-Outline (PW) Packages**

**D, DGV, OR PW PACKAGE**
**(TOP VIEW)**




**DBQ PACKAGE**
**(TOP VIEW)**




NC – No internal connection

## description

The SN74CBTLV3125 quadruple FET bus switch features independent line switches. Each switch is disabled when the associated output-enable ($\overline{OE}$) input is high.

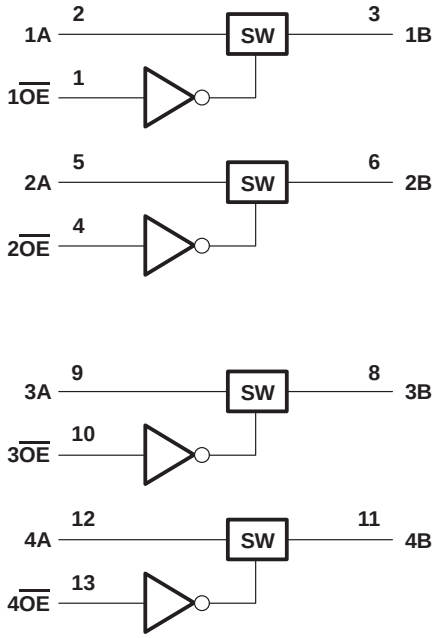
To ensure the high-impedance state during power up or power down, $\overline{OE}$ should be tied to $V_{CC}$ through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

The SN74CBTLV3125 is characterized for operation from –40°C to 85°C.

**FUNCTION TABLE**
**(each bus switch)**

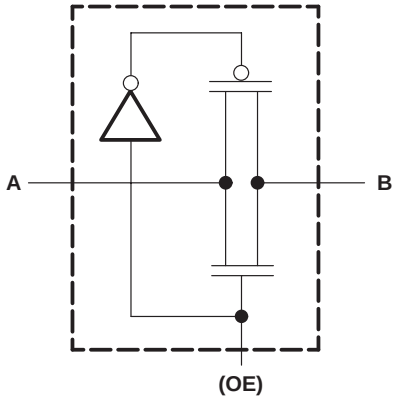
| INPUT $\overline{OE}$ | FUNCTION |
|---|---|
| L | A port = B port |
| H | Disconnect |

## logic diagram (positive logic)




Pin numbers shown are for the D, DGV, and PW packages.

## simplified schematic, each FET switch



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

Supply voltage range, $V_{CC}$ . . . . . –0.5 V to 4.6 V
Input voltage range, $V_I$ (see Note 1) . . . . . –0.5 V to 4.6 V
Continuous channel current . . . . . 128 mA
Input clamp current, $I_{IK}$ ($V_{I/O} < 0$) . . . . . –50 mA
Package thermal impedance, $\theta_{JA}$ (see Note 2): D package . . . . . 86°C/W
DBQ package . . . . . 90°C/W
DGV package . . . . . 127°C/W
PW package . . . . . 113°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 negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. The package thermal impedance is calculated in accordance with JESD 51.

### recommended operating conditions (see Note 3)

| | | | MIN | MAX | UNIT |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply voltage | | 2.3 | 3.6 | V |
| $V_{IH}$ | High-level control input voltage | $V_{CC}$ = 2.3 V to 2.7 V | 1.7 | | V |
| | | $V_{CC}$ = 2.7 V to 3.6 V | 2 | | |
| $V_{IL}$ | Low-level control input voltage | $V_{CC}$ = 2.3 V to 2.7 V | | 0.7 | V |
| | | $V_{CC}$ = 2.7 V to 3.6 V | | 0.8 | |
| $T_A$ | Operating free-air temperature | | –40 | 85 | °C |

NOTE 3: All unused control 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.

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

| PARAMETER | | TEST CONDITIONS | | | MIN | TYP‡ | MAX | UNIT |
|---|---|---|---|---|---|---|---|---|
| $V_{IK}$ | | $V_{CC}$ = 3 V, | $I_I$ = –18 mA | | | | –1.2 | V |
| $I_I$ | | $V_{CC}$ = 3.6 V, | $V_I$ = $V_{CC}$ or GND | | | | ±1 | µA |
| $I_{off}$ | | $V_{CC}$ = 0, | $V_I$ or $V_O$ = 0 to 4.5 V | | | | 10 | µA |
| $I_{CC}$ | | $V_{CC}$ = 3.6 V, | $I_O$ = 0, | $V_I$ = $V_{CC}$ or GND | | | 10 | µA |
| $\Delta I_{CC}$§ | Control inputs | $V_{CC}$ = 3.6 V, | One input at 3 V, | Other inputs at $V_{CC}$ or GND | | | 300 | µA |
| $C_i$ | Control inputs | $V_I$ = 3 V or 0 | | | | 2.5 | | pF |
| $C_{io(OFF)}$ | | $V_O$ = 3 V or 0, | $\overline{OE}$ = $V_{CC}$ | | | 7 | | pF |
| $r_{on}$¶ | | $V_{CC}$ = 2.3 V, TYP at $V_{CC}$ = 2.5 V | $V_I$ = 0 | $I_I$ = 64 mA | | 5 | 8 | Ω |
| | | | | $I_I$ = 24 mA | | 5 | 8 | |
| | | | $V_I$ = 1.7 V, | $I_I$ = 15 mA | | 27 | 40 | |
| | | $V_{CC}$ = 3 V | $V_I$ = 0 | $I_I$ = 64 mA | | 5 | 7 | |
| | | | | $I_I$ = 24 mA | | 5 | 7 | |
| | | | $V_I$ = 2.4 V, | $I_I$ = 15 mA | | 10 | 15 | |

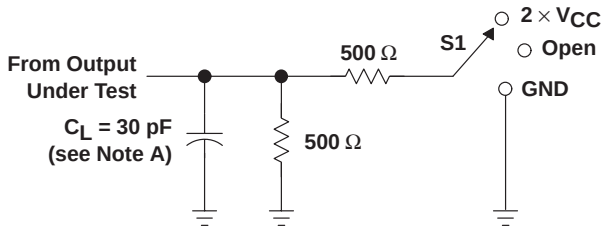
‡ All typical values are at $V_{CC}$ = 3.3 V (unless otherwise noted), $T_A$ = 25°C.
§ This is the increase in supply current for each input that is at the specified voltage level rather than $V_{CC}$ or GND.
¶ Measured by the voltage drop between the A and B terminals at the indicated current through the switch. On-state resistance is determined by the lower of the voltages of the two (A or B) terminals.

**switching characteristics over recommended operating free-air temperature range (unless otherwise noted) (see Figures 1 and 2)**

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $V_{CC}$ = 2.5 V ± 0.2 V | | $V_{CC}$ = 3.3 V ± 0.3 V | | UNIT |
|---|---|---|---|---|---|---|---|
| | | | MIN | MAX | MIN | MAX | |
| $t_{pd}$† | A or B | B or A | | 0.35 | | 0.25 | ns |
| $t_{en}$ | $\overline{OE}$ | A or B | 2 | 4.6 | 2 | 4.4 | ns |
| $t_{dis}$ | $\overline{OE}$ | A or B | 1.1 | 3.9 | 1 | 4.2 | ns |

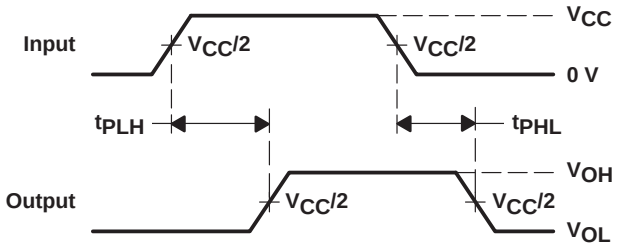
† The propagation delay is the calculated RC time constant of the typical on-state resistance of the switch and the specified load capacitance, when driven by an ideal voltage source (zero output impedance).

## PARAMETER MEASUREMENT INFORMATION
## $V_{CC}$ = 2.5 V ± 0.2 V

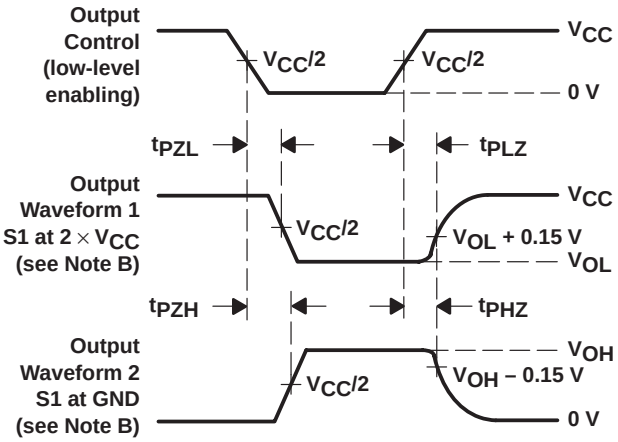



LOAD CIRCUIT

| TEST | S1 |
|---|---|
| $t_{pd}$ | Open |
| $t_{PLZ}/t_{PZL}$ | 2 × $V_{CC}$ |
| $t_{PHZ}/t_{PZH}$ | GND |




VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES

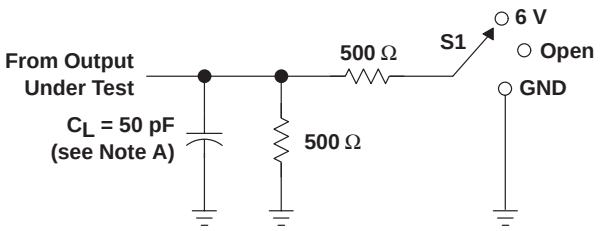



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES

NOTES: A. $C_L$ includes probe and jig 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. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, $Z_O$ = 50 Ω, $t_r$ ≤ 2 ns, $t_f$ ≤ 2 ns.
D. The outputs are measured one at a time with one 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 $t_{pd}$.

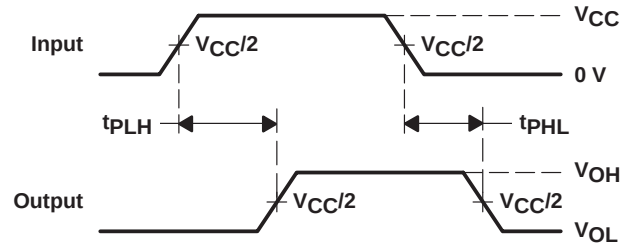
**Figure 1. Load Circuit and Voltage Waveforms**

## PARAMETER MEASUREMENT INFORMATION
## $V_{CC}$ = 3.3 V ± 0.3 V

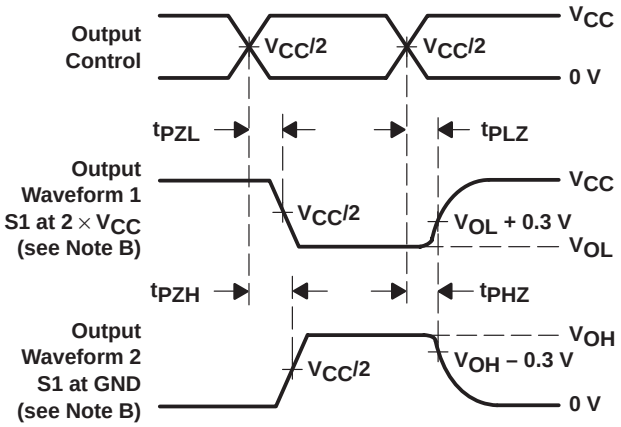



LOAD CIRCUIT

| TEST | S1 |
|---|---|
| $t_{pd}$<br>$t_{PLZ}/t_{PZL}$<br>$t_{PHZ}/t_{PZH}$ | Open<br>2 × $V_{CC}$<br>GND |




VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES

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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 2. Load Circuit and Voltage Waveforms**

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