# LOW-VOLTAGE 8:1 MULTIPLEXER/ DEMULTIPLEXER

**74CBTLV3251**

## FEATURES:

- **Functionally equivalent to QS3251**
- **5Ω bi-directional switch connection between two ports**
- **Isolation under power-off conditions**
- **Over-voltage tolerant**
- **Latch-up performance exceeds 100mA**
- **Vcc = 2.3V - 3.6V, Normal Range**
- **ESD > 2000V per MIL-STD-883, Method 3015; > 200V using machine model (C = 200pF, R = 0)**
- **Available in QSOP and TSSOP packages**

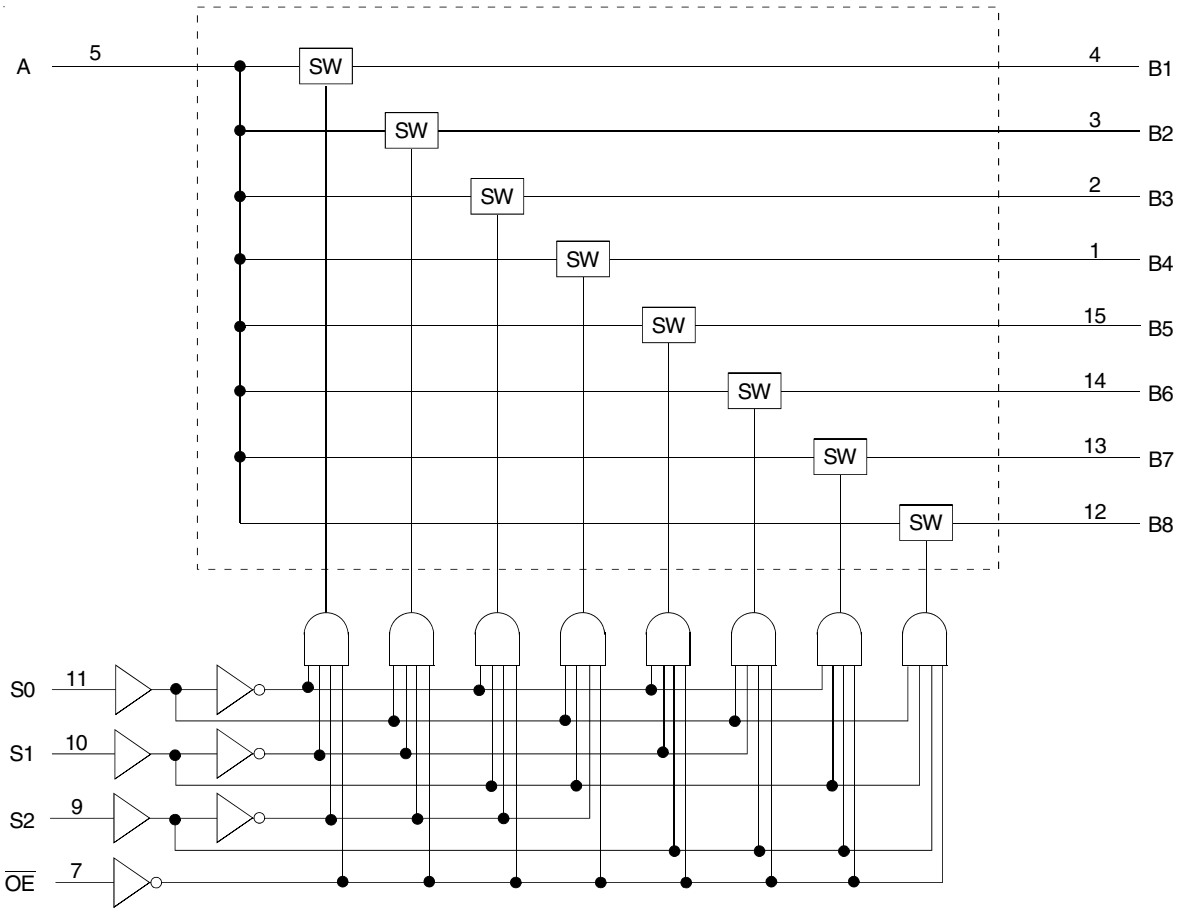
## DESCRIPTION:

The CBTLV3251 is a 1-of-8 high-speed multiplexer/demultiplexer. The low on-state resistance of the switch allows connections to be made with minimal propagation delay.

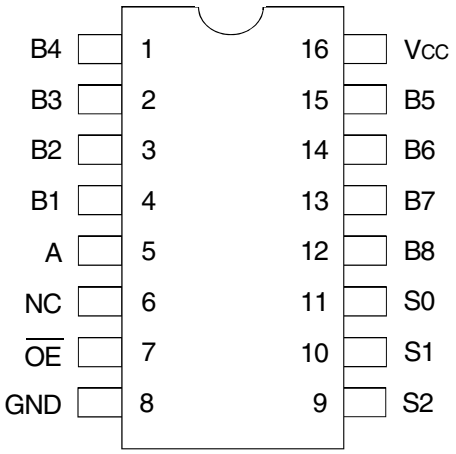
The select input (S0, S1, S2) controls the data flow. The multiplexer/ demultiplexer switches are disabled when the output-enable ($\overline{OE}$) input is high.

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

## FUNCTIONAL BLOCK DIAGRAM



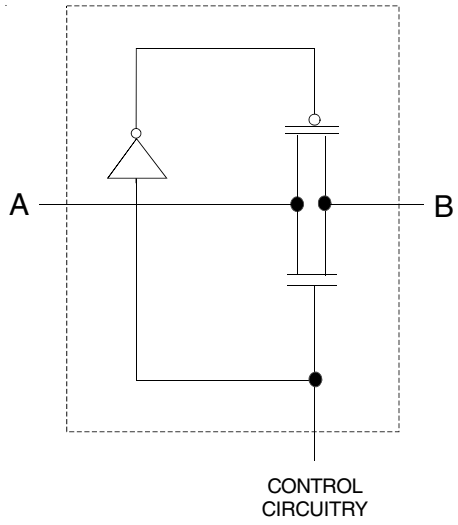
## PIN CONFIGURATION




**TOP VIEW**

| Package Type | Package Code | Order Code |
|---|---|---|
| TSSOP | PGG16 | PGG |
| QSOP | PCG16 | QG |

## SIMPLIFIED SCHEMATIC, EACH SWITCH




## ABSOLUTE MAXIMUM RATINGS(1)

| Symbol | Description | Max | Unit |
|---|---|---|---|
| $V_{CC}$ | SupplyVoltage Range | –0.5 to +4.6 | V |
| $V_I$ | Input Voltage Range | –0.5 to +4.6 | V |
| | Continuous Channel Current | 128 | mA |
| $I_{IK}$ | Input Clamp Current, $V_{I/O} < 0$ | –50 | mA |
| $T_{STG}$ | Storage Temperature | –65 to +150 | °C |

**NOTE:**
1. Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

## FUNCTION TABLE(1)

| Inputs | | | | |
|---|---|---|---|---|
| $\overline{OE}$ | S2 | S1 | S0 | Function |
| L | L | L | L | A Port = B1 Port |
| L | L | L | H | A Port = B2 Port |
| L | L | H | L | A Port = B3 Port |
| L | L | H | H | A Port = B4 Port |
| L | H | L | L | A Port = B5 Port |
| L | H | L | H | A Port = B6 Port |
| L | H | H | L | A Port = B7 Port |
| L | H | H | H | A Port = B8 Port |
| H | X | X | X | Disconnect |

**NOTE:**
1. H = HIGH Voltage Level
   L = LOW Voltage Level
   X = Don't Care

## OPERATING CHARACTERISTICS, $T_A$ = 25°C(1)

| Symbol | Parameter | Test Conditions | Min. | Max. | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage | | 2.3 | 3.6 | V |
| $V_{IH}$ | High-Level Control Input Voltage | $V_{CC}$ = 2.3V to 2.7V | 1.7 | — | V |
| | | $V_{CC}$ = 2.7V to 3.6V | 2 | — | |
| $V_{IL}$ | Low-Level Control Input Voltage | $V_{CC}$ = 2.3V to 2.7V | — | 0.7 | V |
| | | $V_{CC}$ = 2.7V to 3.6V | — | 0.8 | |
| $T_A$ | Operating Free-Air Temperature | | –40 | 85 | °C |

**NOTE:**
1. All unused control inputs of the device must be held at $V_{CC}$ or GND to ensure proper device operation.

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:
Operating Conditions: $T_A$ = –40°C to +85°C

| Symbol | Parameter | Test Conditions | | Min. | Typ.(1) | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{IK}$ | Control Inputs, Data Inputs | $V_{CC}$ = 3V, $I_I$ = –18mA | | — | — | –1.2 | V |
| $I_I$ | Control Inputs | $V_{CC}$ = 3.6V, $V_I$ = $V_{CC}$ or GND | | — | — | ±1 | µA |
| $I_{OZ}$ | Data I/O | $V_{CC}$ = 3.6V, $V_O$ = 0 or 3.6V, switch disabled | | — | — | 5 | µA |
| $I_{OFF}$ | | $V_{CC}$ = 0, $V_I$ or $V_O$ = 0 to 3.6V | | — | — | 50 | µA |
| $I_{CC}$ | | $V_{CC}$ = 3.6V, $I_O$ = 0, $V_I$ = $V_{CC}$ or GND | | — | — | 10 | µA |
| $\Delta I_{CC}$(2) | Control Inputs | $V_{CC}$ = 3.6V, one input at 3V, other inputs at $V_{CC}$ or GND | | — | — | 300 | µA |
| $C_I$ | Control Inputs | $V_I$ = 3V or 0 | | — | 4 | — | pF |
| $C_{IO(OFF)}$ | A Port | $V_O$ = 3V or 0, $\overline{OE}$ = $V_{CC}$ = 3.3V | | — | 40.5 | — | pF |
| | B Port | | | — | 6 | — | |
| $R_{ON}$(3) | $V_{CC}$ = 2.3V Typ. at $V_{CC}$ = 2.5V | $V_I$ = 0 | $I_O$ = 64mA | — | 5 | 8 | Ω |
| | | | $I_O$ = 24mA | — | 5 | 8 | |
| | | $V_I$ = 1.7V | $I_O$ = 15mA | — | 27 | 40 | |
| | $V_{CC}$ = 3V | $V_I$ = 0 | $I_O$ = 64mA | — | 5 | 7 | |
| | | | $I_O$ = 24mA | — | 5 | 7 | |
| | | $V_I$ = 2.4V | $I_O$ = 15mA | — | 10 | 15 | |

**NOTES:**
1. Typical values are at $V_{CC}$ = 3.3V, +25°C ambient.
2. The increase in supply current is attributable to each current that is at the specified voltage level rather than $V_{CC}$ or GND.
3. This is 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

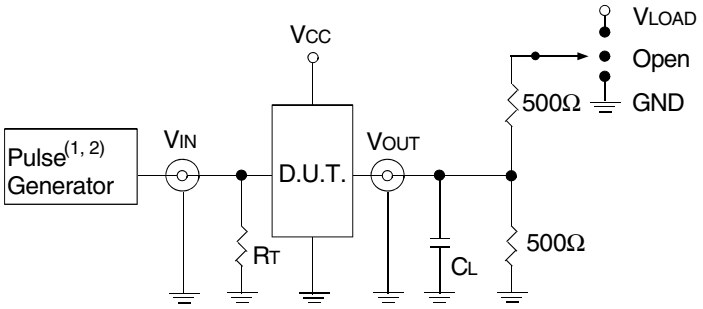
| Symbol | Parameter | $V_{CC}$ = 2.5V ± 0.2V | | $V_{CC}$ = 3.3V ± 0.3V | | Unit |
|---|---|---|---|---|---|---|
| | | Min. | Max. | Min. | Max. | |
| $t_{PD}$(1) | Propagation Delay A to B or B to A | – | 0.15 | – | 0.25 | ns |
| $t_{SEL}$ | Select Time S to A or B | 1 | 4.8 | 1 | 4.5 | ns |
| $t_{EN}$ | Enable Time S to B | 1 | 4.8 | 1 | 4.5 | ns |
| $t_{DIS}$ | Disable Time S to B | 1 | 5.1 | 1 | 5.3 | ns |
| $t_{EN}$ | Output Enable Time $\overline{OE}$ to A or B | 1 | 5 | 1 | 4.8 | ns |
| $t_{DIS}$ | Output Disable Time $\overline{OE}$ to A or B | 1 | 5.5 | 1 | 6 | ns |

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

# TEST CIRCUITS AND WAVEFORMS

## TEST CONDITIONS

| Symbol | $V_{CC}^{(1)}$ = 3.3V±0.3V | $V_{CC}^{(2)}$ = 2.5V±0.2V | Unit |
|---|---|---|---|
| $V_{LOAD}$ | 6 | 2 x Vcc | V |
| $V_{IH}$ | 3 | Vcc | V |
| $V_T$ | 1.5 | Vcc / 2 | V |
| $V_{LZ}$ | 300 | 150 | mV |
| $V_{HZ}$ | 300 | 150 | mV |
| $C_L$ | 50 | 30 | pF |



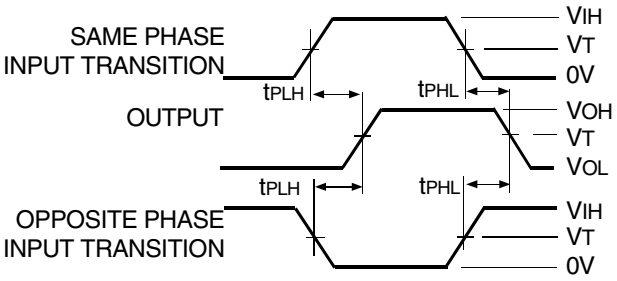

***Test Circuits for All Outputs***

**DEFINITIONS:**
$C_L$ = Load capacitance: includes jig and probe capacitance.
$R_T$ = Termination resistance: should be equal to $Z_{OUT}$ of the Pulse Generator.

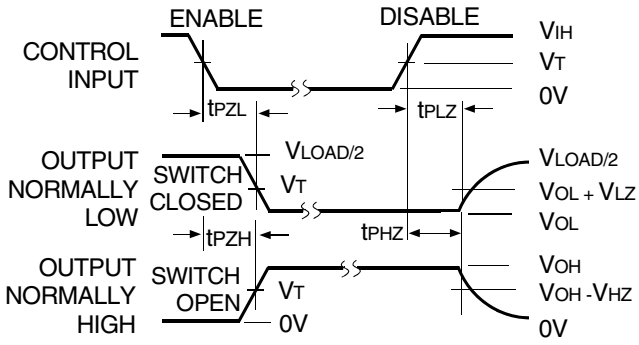
**NOTES:**
1. Pulse Generator for All Pulses: Rate ≤ 10MHz; $t_F$ ≤ 2.5ns; $t_R$ ≤ 2.5ns.
2. Pulse Generator for All Pulses: Rate ≤ 10MHz; $t_F$ ≤ 2ns; $t_R$ ≤ 2.5ns.

## SWITCH POSITION

| Test | Switch |
|---|---|
| $t_{PLZ}/t_{PZL}$ | $V_{LOAD}$ |
| $t_{PHZ}/t_{PZH}$ | GND |
| $t_{SEL}$ | Open |
| $t_{PD}$ | Open |

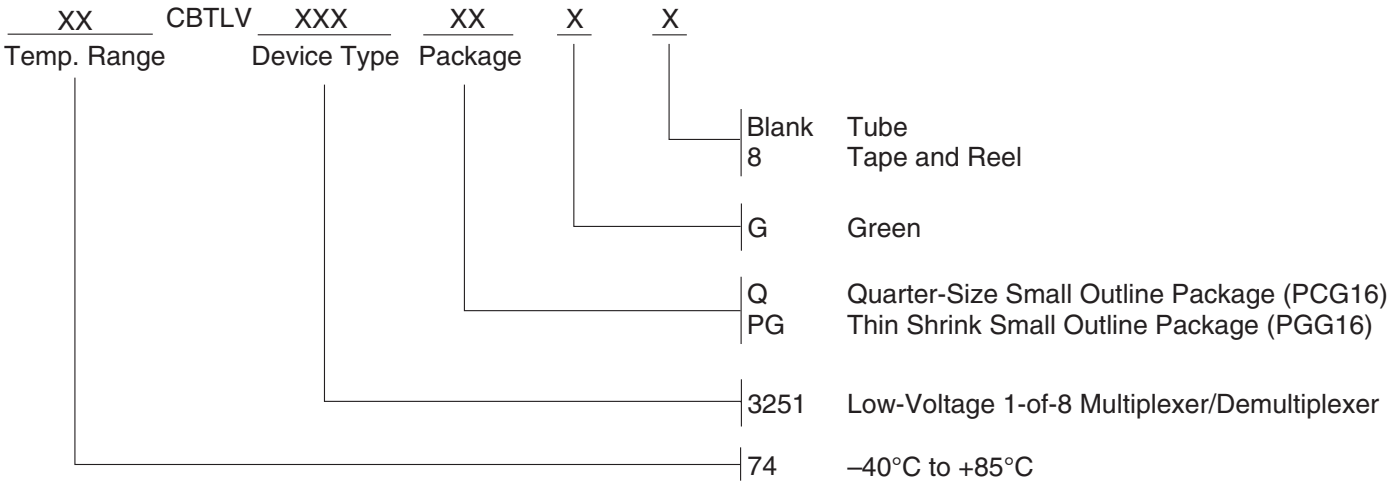



***Propagation Delay***




***Enable and Disable Times***

## ORDERING INFORMATION




## Orderable Part Information

| Speed (ns) | Orderable Part ID | Pkg. Code | Pkg. Type | Temp. Grade |
|---|---|---|---|---|
| | 74CBTLV3251PGG | PGG16 | TSSOP | I |
| | 74CBTLV3251PGG8 | PGG16 | TSSOP | I |
| | 74CBTLV3251QG | PCG16 | QSOP | I |
| | 74CBTLV3251QG8 | PCG16 | QSOP | I |

## Datasheet Document History

| | | |
|---|---|---|
| 12/18/2014 | Pg. 5 | Updated the ordering information by removing non RoHS part and adding Tape and Reel information. |
| 05/10/2019 | Pg. 2,5 | Added table under pin configuration diagram with detailed package information and orderable part information table. Updated the ordering information diagram in clearer detail. |