



## LOW-VOLTAGE 10-BIT BUS SWITCH

**IDT74CBTLV3384**

### FEATURES:

- $5\Omega$  A/B bi-directional bus switch
- Isolation under power-off conditions
- Over-voltage tolerant
- Latch-up performance exceeds 100mA
- $V_{CC} = 2.3V - 3.6V$ , Normal Range
- ESD > 2000V per MIL-STD-883, Method 3015;  
> 200V using machine model (C = 200pF, R = 0)
- Available in QSOP and TSSOP packages

### APPLICATIONS:

- 3.3V High Speed Bus Switching and Bus Isolation

### DESCRIPTION:

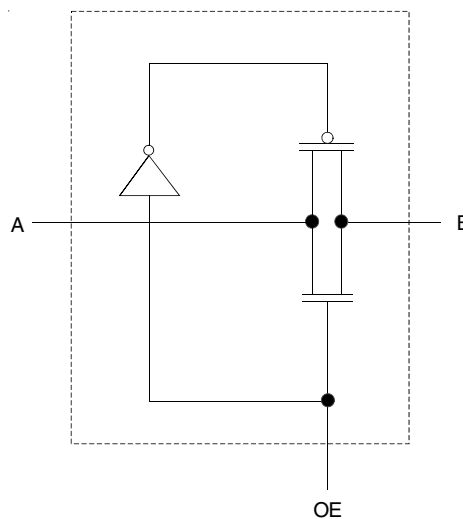
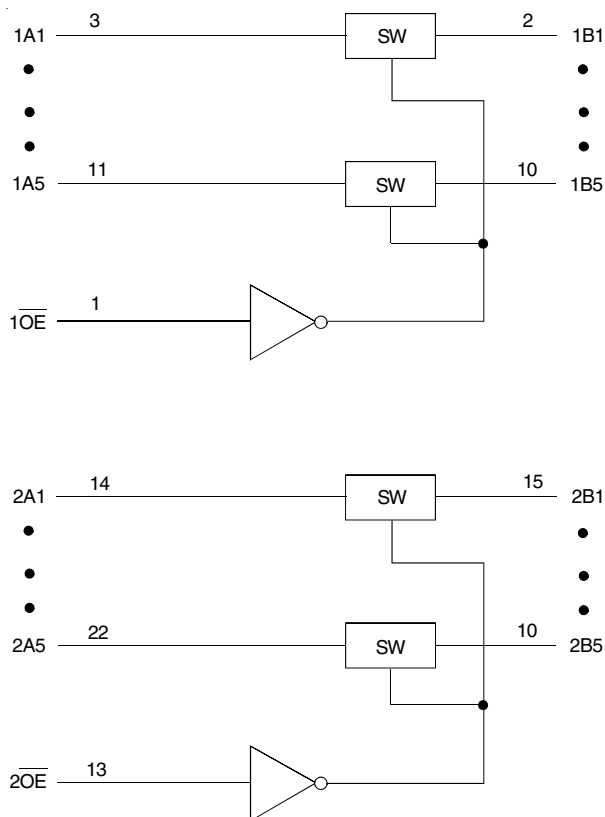
The CBTLV3384 is a ten bit high-speed bus switch with low on-state resistance of the switch allowing connections to be made with minimal propagation delay.

The device is organized as dual 5-bit bus switches with separate output-enable ( $\overline{OE}$ ) inputs, to allow use as two 5-bit bus switches or one 10-bit bus switch. When  $\overline{OE}$  is low, the associated 5-bit bus switch is on and A port is connected to B port. When  $\overline{OE}$  is high, the switch is open, and a high-impedance state exists between the two ports.

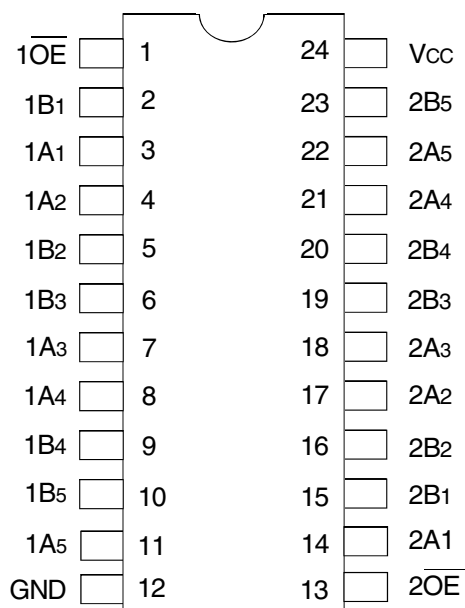
To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

### FUNCTIONAL BLOCK DIAGRAM

### SIMPLIFIED SCHEMATIC, EACH SWITCH



## PIN CONFIGURATION



QSOP/TSSOP  
TOP VIEW

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

| Symbol           | Description                              | Max          | Unit |
|------------------|------------------------------------------|--------------|------|
| V <sub>CC</sub>  | Supply Voltage Range                     | -0.5 to +4.6 | V    |
| V <sub>I</sub>   | Input Voltage Range                      | -0.5 to +4.6 | V    |
|                  | Continuous Channel Current               | 128          | mA   |
| I <sub>IK</sub>  | Input Clamp Current, V <sub>IO</sub> < 0 | -50          | mA   |
| T <sub>STG</sub> | Storage Temperature                      | -65 to +150  | °C   |

NOTE:

- 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<sup>(1)</sup>

| Input |     | Inputs/Outputs |           |
|-------|-----|----------------|-----------|
| 1OE   | 2OE | 1B1 - 1B5      | 2B1 - 2B5 |
| L     | L   | 1A1 - 1A5      | 2A1 - 2A5 |
| L     | H   | 1A1 - 1A5      | Z         |
| H     | L   | Z              | 2A1 - 2A5 |
| H     | H   | Z              | Z         |

NOTE:

- H = HIGH Voltage Level  
L = LOW Voltage Level  
Z = High Impedance

## OPERATING CHARACTERISTICS, T<sub>A</sub> = 25°C<sup>(1)</sup>

| Symbol          | Parameter                        | Test Conditions                | Min. | Max. | Unit |
|-----------------|----------------------------------|--------------------------------|------|------|------|
| V <sub>CC</sub> | Supply Voltage                   |                                | 2.3  | 3.6  | V    |
| V <sub>IH</sub> | High-Level Control Input Voltage | V <sub>CC</sub> = 2.3V to 2.7V | 1.7  | —    | V    |
|                 |                                  | V <sub>CC</sub> = 2.7V to 3.6V | 2    | —    |      |
| V <sub>IL</sub> | Low-Level Control Input Voltage  | V <sub>CC</sub> = 2.3V to 2.7V | —    | 0.7  | V    |
|                 |                                  | V <sub>CC</sub> = 2.7V to 3.6V | —    | 0.8  |      |
| T <sub>A</sub>  | Operating Free-Air Temperature   |                                | -40  | 85   | °C   |

NOTE:

- All unused control inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation.

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Operating Conditions:  $T_A = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$

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

### NOTES:

- The increase in supply current is attributable to each current that is at the specified voltage level rather than  $V_{CC}$  or GND.
- 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                                        | $V_{CC} = 2.5\text{V} \pm 0.2\text{V}$ |      | $V_{CC} = 3.3\text{V} \pm 0.3\text{V}$ |      | Unit |
|----------------|--------------------------------------------------|----------------------------------------|------|----------------------------------------|------|------|
|                |                                                  | Min.                                   | Max. | Min.                                   | Max. |      |
| $t_{PD}^{(1)}$ | Propagation Delay<br>A to B or B to A            | —                                      | 0.15 | —                                      | 0.25 | ns   |
| $t_{EN}$       | Output Enable Time<br>$\overline{OE}$ to A or B  | 1                                      | 5    | 1                                      | 4.3  | ns   |
| $t_{DIS}$      | Output Disable Time<br>$\overline{OE}$ to A or B | 1                                      | 5.5  | 1                                      | 5.5  | ns   |

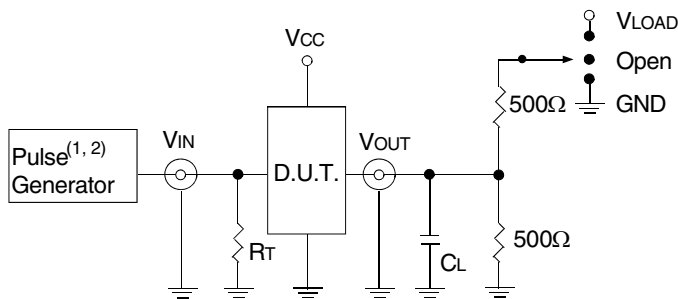
### NOTE:

- 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     | $V_{CC}^{(1)} = 3.3V \pm 0.3V$ | $V_{CC}^{(2)} = 2.5V \pm 0.2V$ | Unit |
|------------|--------------------------------|--------------------------------|------|
| $V_{LOAD}$ | 6                              | $2 \times V_{CC}$              | V    |
| $V_{IH}$   | 3                              | $V_{CC}$                       | V    |
| $V_T$      | 1.5                            | $V_{CC} / 2$                   | 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.

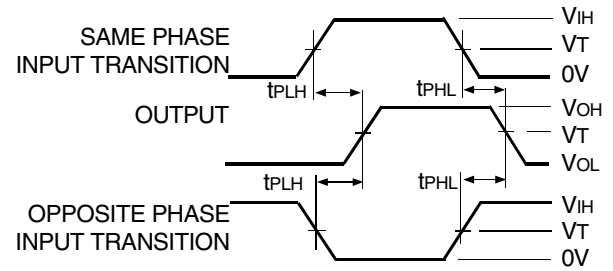
$R_T$  = Termination resistance: should be equal to  $Z_{OUT}$  of the Pulse Generator.

#### NOTES:

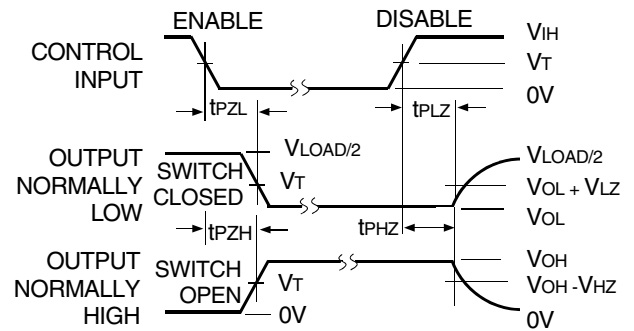
1. Pulse Generator for All Pulses: Rate  $\leq 10\text{MHz}$ ;  $t_r \leq 2.5\text{ns}$ ;  $t_f \leq 2.5\text{ns}$ .
2. Pulse Generator for All Pulses: Rate  $\leq 10\text{MHz}$ ;  $t_r \leq 2\text{ns}$ ;  $t_f \leq 2.5\text{ns}$ .

### SWITCH POSITION

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



Propagation Delay



Enable and Disable Times

## ORDERING INFORMATION

| XX          | CBTLV | XXX         | XX      | X     |                                            |  |
|-------------|-------|-------------|---------|-------|--------------------------------------------|--|
| Temp. Range |       | Device Type | Package |       |                                            |  |
|             |       |             |         | Blank | Tube or Tray                               |  |
|             |       |             |         | 8     | Tape and Reel                              |  |
|             |       |             |         | QG    | Quarter-Size Small Outline Package - Green |  |
|             |       |             |         | PGG   | Thin Shrink Small Outline Package - Green  |  |
|             |       |             |         | 3384  | Low-Voltage 10-Bit Bus Switch              |  |
|             |       |             |         | 74    | −40°C to +85°C                             |  |

## Datasheet Document History

12/18/2014 Pg. 5 Updated the ordering information by removing non RoHS part and by adding Tape and Reel information.



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