



January 2001
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74LVT32244 • 74LVTH32244

Low Voltage 32-Bit Buffer/Line Driver with 3-STATE Outputs (Preliminary)

General Description

The LVT32244 and LVTH32244 contain thirty-two non-inverting buffers with 3-STATE outputs designed to be employed as a memory and address driver, clock driver, or bus oriented transmitter/receiver. The device is nibble controlled. Individual 3-STATE control inputs can be shorted together for 8-bit, 16-bit, or 32-bit operation.

The LVTH32244 data inputs include bushold, eliminating the need for external pull-up resistors to hold unused inputs.

These buffers and line drivers are designed for low-voltage (3.3V) V_{CC} applications, but with the capability to provide a TTL interface to a 5V environment. The LVT32244 and LVTH32244 are fabricated with an advanced BiCMOS technology to achieve high speed operation similar to 5V ABT while maintaining a low power dissipation

Features

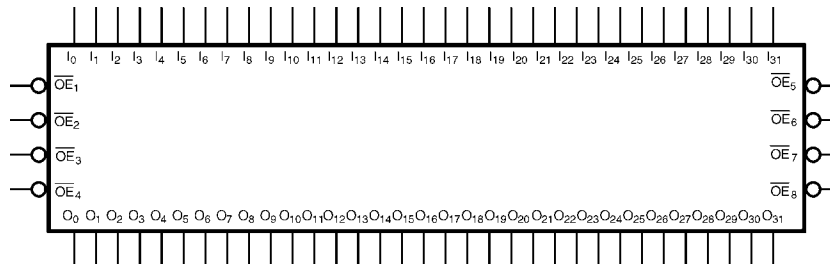
- Input and output interface capability to systems at 5V V_{CC}
- Bushold data inputs eliminate the need for external pull-up resistors to hold unused inputs (74LVTH32244), also available without bushold feature (74LVT32244).
- Live insertion/extraction permitted
- Power Up/Down high impedance provides glitch-free bus loading
- Outputs source/sink -32 mA/+64 mA
- ESD performance:
 - Human-body model > 2000V
 - Machine model > 200V
 - Charged-device model > 1000V
- Packaged in plastic Fine-Pitch Ball Grid Array (FBGA) (Preliminary)

Ordering Code:

| Order Number | Package Number | Package Description |
|---------------------------|-------------------------|---|
| 74LVT32244GX (Note 1) | BGA96A (Preliminary) | 96-Ball Fine-Pitch Ball Grid Array (FBGA), JEDEC MO-205, 5.5mm Wide [Tape and Reel] |
| 74LVTH32244GX (Note 1) | BGA96A (Preliminary) | 96-Ball Fine-Pitch Ball Grid Array (FBGA), JEDEC MO-205, 5.5mm Wide [Tape and Reel] |

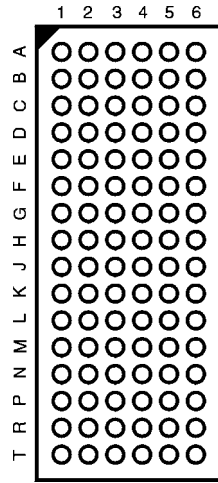
Note 1: BGA package available in Tape and Reel only.

Logic Symbol



74LVT32244 • 74LVTH32244 Low Voltage 32-Bit Buffer/Line Driver with 3-STATE Outputs (Preliminary)

Connection Diagram



(Top Thru View)

Pin Descriptions

| Pin Names | Description |
|-------------------|----------------------------------|
| \overline{OE}_n | Output Enable Input (Active LOW) |
| I_0-I_{31} | Inputs |
| O_0-O_{31} | Outputs |

Pin Assignments for FBGA

| | 1 | 2 | 3 | 4 | 5 | 6 |
|----------|----------|----------|-------------------|-------------------|----------|----------|
| A | O_1 | O_0 | \overline{OE}_1 | \overline{OE}_2 | I_0 | I_1 |
| B | O_3 | O_2 | GND | GND | I_2 | I_3 |
| C | O_5 | O_4 | V_{CC1} | V_{CC1} | I_4 | I_5 |
| D | O_7 | O_6 | GND | GND | I_6 | I_7 |
| E | O_9 | O_8 | GND | GND | I_8 | I_9 |
| F | O_{11} | O_{10} | V_{CC1} | V_{CC1} | I_{10} | I_{11} |
| G | O_{13} | O_{12} | GND | GND | I_{12} | I_{13} |
| H | O_{14} | O_{15} | \overline{OE}_4 | \overline{OE}_3 | I_{15} | I_{14} |
| J | O_{17} | O_{16} | \overline{OE}_5 | \overline{OE}_6 | I_{16} | I_{17} |
| K | O_{19} | O_{18} | GND | GND | I_{18} | I_{19} |
| L | O_{21} | O_{20} | V_{CC2} | V_{CC2} | I_{20} | I_{21} |
| M | O_{23} | O_{22} | GND | GND | I_{22} | I_{23} |
| N | O_{25} | O_{24} | GND | GND | I_{24} | I_{25} |
| P | O_{27} | O_{26} | V_{CC2} | V_{CC2} | I_{26} | I_{27} |
| R | O_{29} | O_{28} | GND | GND | I_{28} | I_{29} |
| T | O_{30} | O_{31} | \overline{OE}_8 | \overline{OE}_7 | I_{31} | I_{30} |

Truth Tables

| Inputs | | Outputs |
|-------------------|-----------|-----------|
| \overline{OE}_1 | I_0-I_3 | O_0-O_3 |
| L | L | L |
| L | H | H |
| H | X | Z |

| Inputs | | Outputs |
|-------------------|-----------|-----------|
| \overline{OE}_2 | I_4-I_7 | O_4-O_7 |
| L | L | L |
| L | H | H |
| H | X | Z |

| Inputs | | Outputs |
|-------------------|--------------|--------------|
| \overline{OE}_3 | I_8-I_{11} | O_8-O_{11} |
| L | L | L |
| L | H | H |
| H | X | Z |

| Inputs | | Outputs |
|-------------------|-----------------|-----------------|
| \overline{OE}_4 | $I_{12}-I_{15}$ | $O_{12}-O_{15}$ |
| L | L | L |
| L | H | H |
| H | X | Z |

| Inputs | | Outputs |
|-------------------|-----------------|-----------------|
| \overline{OE}_5 | $I_{16}-I_{19}$ | $O_{16}-O_{19}$ |
| L | L | L |
| L | H | H |
| H | X | Z |

| Inputs | | Outputs |
|-------------------|-----------------|-----------------|
| \overline{OE}_6 | $I_{20}-I_{23}$ | $O_{20}-O_{23}$ |
| L | L | L |
| L | H | H |
| H | X | Z |

| Inputs | | Outputs |
|-------------------|-----------------|-----------------|
| \overline{OE}_7 | $I_{24}-I_{27}$ | $O_{24}-O_{27}$ |
| L | L | L |
| L | H | H |
| H | X | Z |

| Inputs | | Outputs |
|-------------------|-----------------|-----------------|
| \overline{OE}_8 | $I_{28}-I_{31}$ | $O_{28}-O_{31}$ |
| L | L | L |
| L | H | H |
| H | X | Z |

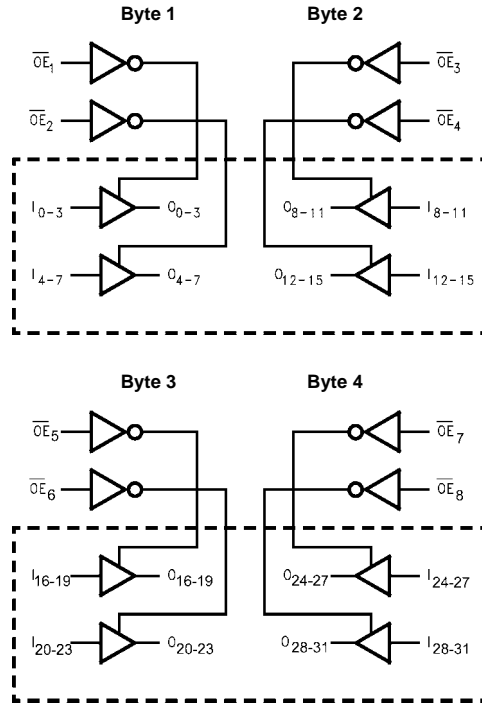
H = HIGH Voltage Level
 L = LOW Voltage Level
 X = Immaterial (HIGH or LOW, inputs may not float)
 Z = High Impedance

Functional Description

The 74LVTH32244 and 74LVTH32244 contain thirty-two non-inverting buffers with 3-STATE outputs. The device is nibble (4 bits) controlled with each nibble functioning identically, but independent of the other. The control pins can be shorted together to obtain full 32-bit operation. The

3-STATE outputs are controlled by an Output Enable (\overline{OE}_n) input. When \overline{OE}_n is LOW, the outputs are in the 2-state mode. When \overline{OE}_n is HIGH, the standard outputs are in the high impedance mode but this does not interfere with entering new data into the inputs.

Logic Diagrams



V_{CC1} is associated with Bytes 1 and 2.

V_{CC2} is associated with Bytes 3 and 4.

Note: Please note that these diagrams are provided only for the understanding of logic operations and should not be used to estimate propagation delays.

| Absolute Maximum Ratings (Note 2) | | | | | |
|-----------------------------------|----------------------------------|--------------|--------------------------------------|--|--------------------|
| Symbol | Parameter | Value | Conditions | | Units |
| V_{CC} | Supply Voltage | -0.5 to +4.6 | | | V |
| V_I | DC Input Voltage | -0.5 to +7.0 | | | V |
| V_O | Output Voltage | -0.5 to +7.0 | Output in 3-STATE | | V |
| | | -0.5 to +7.0 | Output in High or Low State (Note 3) | | |
| I_{IK} | DC Input Diode Current | -50 | $V_I < \text{GND}$ | | mA |
| I_{OK} | DC Output Diode Current | -50 | $V_O < \text{GND}$ | | mA |
| I_O | DC Output Current | 64 | $V_O > V_{CC}$ Output at HIGH State | | mA |
| | | 128 | $V_O > V_{CC}$ Output at LOW State | | |
| I_{CC} | DC Supply Current per Supply Pin | ± 64 | | | mA |
| I_{GND} | DC Ground Current per Ground Pin | ± 128 | | | mA |
| T_{STG} | Storage Temperature | -65 to +150 | | | $^{\circ}\text{C}$ |

| Recommended Operating Conditions | | | | | |
|----------------------------------|--|-----|-----|--------------------|--|
| Symbol | Parameter | Min | Max | Units | |
| V_{CC} | Supply Voltage | 2.7 | 3.6 | V | |
| V_I | Input Voltage | 0 | 5.5 | V | |
| I_{OH} | High-Level Output Current | | -32 | mA | |
| I_{OL} | Low-Level Output Current | | 64 | mA | |
| T_A | Free Air Operating Temperature | -40 | +85 | $^{\circ}\text{C}$ | |
| $\Delta t/\Delta V$ | Input Edge Rate, $V_{IN} = 0.8\text{V}-2.0\text{V}$, $V_{CC} = 3.0\text{V}$ | 0 | 10 | ns/V | |

Note 2: Absolute Maximum continuous ratings are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute maximum rated conditions is not implied.

Note 3: I_O Absolute Maximum Rating must be observed.

| DC Electrical Characteristics | | | | | | | |
|----------------------------------|---|-----------------|--|-------------------------|---------------|--|-------------------------------|
| Symbol | Parameter | V_{CC} (V) | $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ | | Units | Conditions | |
| | | | Min | Max | | | |
| V_{IK} | Input Clamp Diode Voltage | 2.7 | | -1.2 | V | $I_I = -18\text{ mA}$ | |
| V_{IH} | Input HIGH Voltage | 2.7-3.6 | 2.0 | | V | $V_O \leq 0.1\text{V}$ or $V_O \geq V_{CC} - 0.1\text{V}$ | |
| V_{IL} | Input LOW Voltage | 2.7-3.6 | | 0.8 | V | | |
| V_{OH} | Output HIGH Voltage | 2.7-3.6 | $V_{CC} - 0.2$ | | V | $I_{OH} = -100\ \mu\text{A}$ | |
| | | 2.7 | 2.4 | | | $I_{OH} = -8\text{ mA}$ | |
| | | 3.0 | 2.0 | | | $I_{OH} = -32\text{ mA}$ | |
| V_{OL} | Output LOW Voltage | 2.7 | | 0.2 | V | $I_{OL} = 100\ \mu\text{A}$ | |
| | | 2.7 | | 0.5 | | $I_{OL} = 24\text{ mA}$ | |
| | | 3.0 | | 0.4 | | $I_{OL} = 16\text{ mA}$ | |
| | | 3.0 | | 0.5 | | $I_{OL} = 32\text{ mA}$ | |
| 3.0 | | 0.55 | | $I_{OL} = 64\text{ mA}$ | | | |
| $I_{I(\text{HOLD})}$ (Note 4) | Bushold Input Minimum Drive | 3.0 | 75 | | μA | $V_I = 0.8\text{V}$ | |
| | | | -75 | | | $V_I = 2.0\text{V}$ | |
| $I_{I(\text{OD})}$ (Note 4) | Bushold Input Over-Drive Current to Change State | 3.0 | 500 | | μA | (Note 5) | |
| | | | -500 | | | (Note 6) | |
| I_I | Input Current | 3.6 | | 10 | μA | $V_I = 5.5\text{V}$ | |
| | | Control Pins | 3.6 | | | ± 1 | $V_I = 0\text{V}$ or V_{CC} |
| | | | Data Pins | 3.6 | | | -5 |
| | | | | 1 | | $V_I = V_{CC}$ | |
| I_{OFF} | Power Off Leakage Current | 0 | | ± 100 | μA | $0\text{V} \leq V_I$ or $V_O \leq 5.5\text{V}$ | |
| $I_{PU/PD}$ | Power Up/Down 3-STATE Current | 0 - 1.5V | | ± 100 | μA | $V_O = 0.5\text{V}$ to 3.0V $V_I = \text{GND}$ or V_{CC} | |
| I_{OZL} | 3-STATE Output Leakage Current | 3.6 | | -5 | μA | $V_O = 0.5\text{V}$ | |
| I_{OZH} | 3-STATE Output Leakage Current | 3.6 | | 5 | μA | $V_O = 3.0\text{V}$ | |
| I_{OZH+} | 3-STATE Output Leakage Current | 3.6 | | 10 | μA | $V_{CC} < V_O \leq 5.5\text{V}$ | |

| DC Electrical Characteristics (Continued) | | | | | | | |
|---|--|--|---------------------------------|------------------------|-------|---|---|
| Symbol | Parameter | V _{CC} (V) | T _A = -40°C to +85°C | | Units | Conditions | |
| | | | Min | Max | | | |
| I _{CC} H | Power Supply Current | V _{CC1} or V _{CC2} | 3.6 | 0.19 | mA | Outputs High | |
| I _{CC} L | Power Supply Current | V _{CC1} or V _{CC2} | 3.6 | 5.0 | mA | Outputs Low | |
| I _{CC} Z | Power Supply Current | V _{CC1} or V _{CC2} | 3.6 | 0.19 | mA | Outputs Disabled | |
| I _{CC} Z ⁺ | Power Supply Current | V _{CC1} or V _{CC2} | 3.6 | 0.19 | mA | V _{CC} ≤ V _O ≤ 5.5V, Outputs Disabled | |
| ΔI _{CC} | Increase in Power Supply Current (Note 7) | V _{CC1} or V _{CC2} | 3.6 | 0.2 | mA | One Input at V _{CC} - 0.6V Other Inputs at V _{CC} or GND | |
| <p>Note 4: Applies to bushold versions only (LVTH32244).</p> <p>Note 5: An external driver must source at least the specified current to switch from LOW-to-HIGH.</p> <p>Note 6: An external driver must sink at least the specified current to switch from HIGH-to-LOW.</p> <p>Note 7: This is the increase in supply current for each input that is at the specified voltage level rather than V_{CC} or GND.</p> | | | | | | | |
| Dynamic Switching Characteristics (Note 8) | | | | | | | |
| Symbol | Parameter | V _{CC} (V) | T _A = 25°C | | | Units | Conditions C _L = 50 pF, R _L = 500Ω |
| | | | Min | Typ | Max | | |
| V _{OLP} | Quiet Output Maximum Dynamic V _{OL} | 3.3 | | 0.8 | | V | (Note 9) |
| V _{OLV} | Quiet Output Minimum Dynamic V _{OL} | 3.3 | | -0.8 | | V | (Note 9) |
| <p>Note 8: Characterized in SSOP package. Guaranteed parameter, but not tested.</p> <p>Note 9: Max number of outputs defined as (n). n-1 data inputs are driven 0V to 3V. Output under test held LOW.</p> | | | | | | | |
| AC Electrical Characteristics | | | | | | | |
| Symbol | Parameter | T _A = -40°C to +85°C C _L = 50 pF, R _L = 500Ω | | | | Units | |
| | | V _{CC} = 3.3V ± 0.3V | | V _{CC} = 2.7V | | | |
| | | Min | Max | Min | Max | | |
| t _{PLH} | Propagation Delay Data to Output | 1.2 | 3.5 | 1.2 | 3.9 | ns | |
| t _{PHL} | | 1.2 | 3.5 | 1.2 | 3.9 | | |
| t _{PZH} | Output Enable Time | 1.2 | 4.0 | 1.2 | 5.0 | ns | |
| t _{PZL} | | 1.2 | 5.0 | 1.2 | 6.5 | | |
| t _{PHZ} | Output Disable Time | 2.0 | 4.7 | 2.0 | 5.2 | ns | |
| t _{PLZ} | | 1.5 | 4.2 | 1.5 | 4.4 | | |
| Capacitance (Note 10) | | | | | | | |
| Symbol | Parameter | Conditions | | Typical | Units | | |
| C _{IN} | Input Capacitance | V _{CC} = 0V, V _I = 0V or V _{CC} | | 4 | pF | | |
| C _{OUT} | Output Capacitance | V _{CC} = 3.0V, V _O = 0V or V _{CC} | | 8 | pF | | |
| <p>Note 10: Capacitance is measured at frequency f = 1 MHz, per MIL-STD-883, Method 3012.</p> | | | | | | | |

