



# 3.3V CMOS 32-BIT BUFFER/ DRIVER WITH 3-STATE OUTPUTS AND BUS-HOLD

**IDT74ALVCH32244**

## FEATURES:

- 0.5 MICRON CMOS Technology
- Typical  $t_{sk(o)}$  (Output Skew) < 250ps
- ESD > 2000V per MIL-STD-883, Method 3015; > 200V using machine model (C = 200pF, R = 0)
- $V_{CC} = 3.3V \pm 0.3V$ , Normal Range
- $V_{CC} = 2.7V$  to  $3.6V$ , Extended Range
- $V_{CC} = 2.5V \pm 0.2V$
- CMOS power levels (0.4μ W typ. static)
- Rail-to-Rail output swing for increased noise margin
- Available in 96-ball LFBGA package

## DRIVE FEATURES:

- High Output Drivers:  $\pm 24mA$
- Suitable for Heavy Loads

## APPLICATIONS:

- 3.3V high speed systems
- 3.3V and lower voltage computing systems

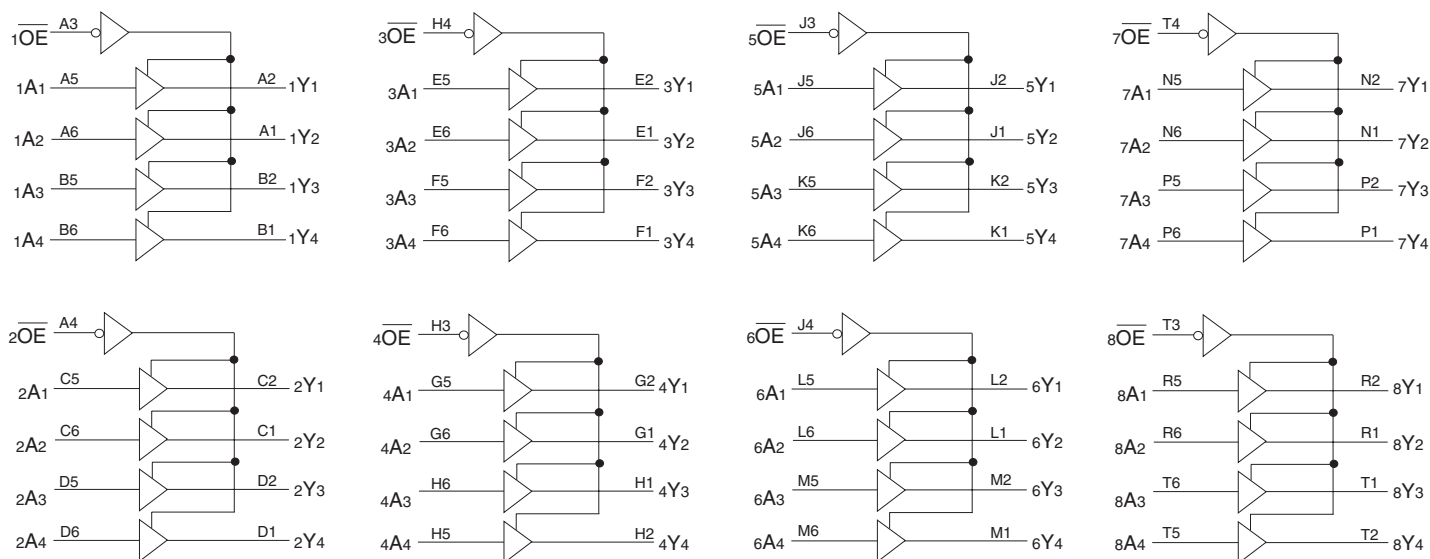
## DESCRIPTION:

This 32-bit buffer/driver is built using advanced dual metal CMOS technology. This high-speed, low power device offers bus/backplane interface capability with improved packing density. The device has a flow-through organization for simplifying board layout. The three-state controls operate this device in a Quad-Nibble, Dual-Byte or single 16-bit word mode. All inputs are designed with hysteresis for improved noise margin.

The ALVCH32244 has been designed with a  $\pm 24mA$  output driver. This driver is capable of driving a moderate to heavy load while maintaining speed performance.

The ALVCH32244 has "bus-hold" which retains the inputs' last state whenever the input bus goes to a high impedance. This prevents floating inputs and eliminates the need for pull-up/down resistors.

## FUNCTIONAL BLOCK DIAGRAM



IDT and the IDT logo are registered trademarks of Integrated Device Technology, Inc.

**INDUSTRIAL TEMPERATURE RANGE**

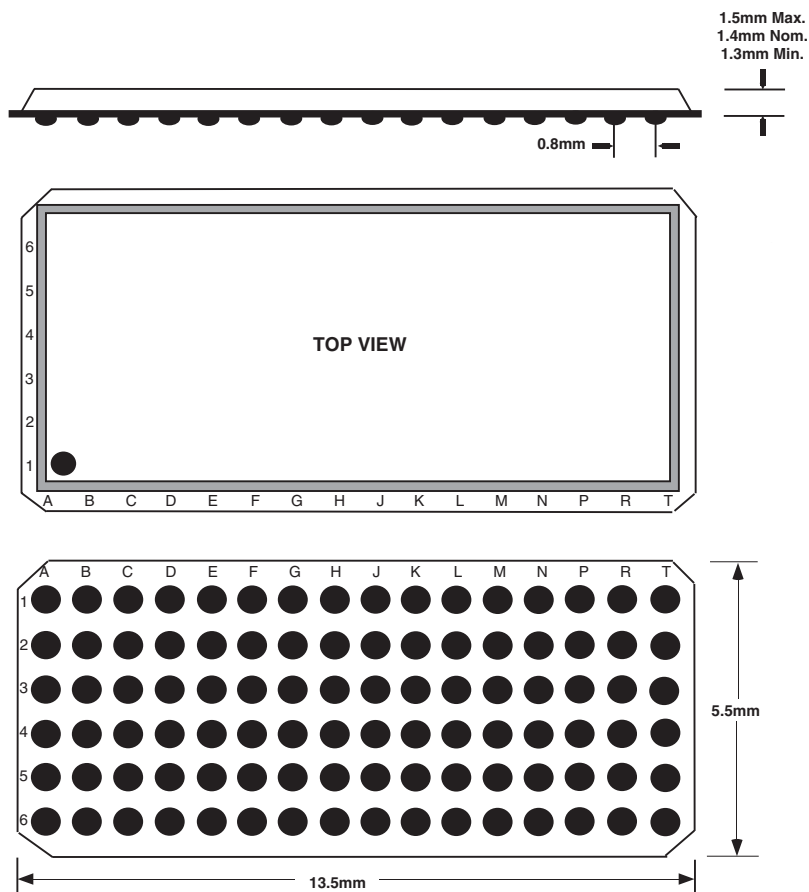
**AUGUST 2009**

### PIN CONFIGURATION

|   |                   |     |     |     |     |     |     |                   |                   |     |     |     |     |     |     |                   |
|---|-------------------|-----|-----|-----|-----|-----|-----|-------------------|-------------------|-----|-----|-----|-----|-----|-----|-------------------|
| 6 | 1A2               | 1A4 | 2A2 | 2A4 | 3A2 | 3A4 | 4A2 | 4A3               | 5A2               | 5A4 | 6A2 | 6A4 | 7A2 | 7A4 | 8A2 | 8A3               |
| 5 | 1A1               | 1A3 | 2A1 | 2A3 | 3A1 | 3A3 | 4A1 | 4A4               | 5A1               | 5A3 | 6A1 | 6A3 | 7A1 | 7A3 | 8A1 | 8A4               |
| 4 | 2 $\overline{OE}$ | GND | VCC | GND | GND | VCC | GND | 3 $\overline{OE}$ | 6 $\overline{OE}$ | GND | VCC | GND | GND | VCC | GND | 7 $\overline{OE}$ |
| 3 | 1 $\overline{OE}$ | GND | VCC | GND | GND | VCC | GND | 4 $\overline{OE}$ | 5 $\overline{OE}$ | GND | VCC | GND | GND | VCC | GND | 8 $\overline{OE}$ |
| 2 | 1Y1               | 1Y3 | 2Y1 | 2Y3 | 3Y1 | 3Y3 | 4Y1 | 4Y4               | 5Y1               | 5Y3 | 6Y1 | 6Y3 | 7Y1 | 7Y3 | 8Y1 | 8Y4               |
| 1 | 1Y2               | 1Y4 | 2Y2 | 2Y4 | 3Y2 | 3Y4 | 4Y2 | 4Y3               | 5Y2               | 5Y4 | 6Y2 | 6Y4 | 7Y2 | 7Y4 | 8Y2 | 8Y3               |
|   | A                 | B   | C   | D   | E   | F   | G   | H                 | J                 | K   | L   | M   | N   | P   | R   | T                 |

LFBGA  
TOPVIEW

### 96 BALL LFBGA PACKAGE ATTRIBUTES



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

| Symbol                             | Description  | Max                          | Unit |
|------------------------------------|--|------------------------------|------|
| V <sub>TERM</sub> <sup>(2)</sup>   | Terminal Voltage with Respect to GND   | -0.5 to +4.6                 | V    |
| V <sub>TERM</sub> <sup>(3)</sup>   | Terminal Voltage with Respect to GND   | -0.5 to V <sub>CC</sub> +0.5 | V    |
| T <sub>STG</sub>                   | Storage Temperature  | -65 to +150                  | °C   |
| I <sub>OUT</sub>                   | DC Output Current  | -50 to +50                   | mA   |
| I <sub>IK</sub>                    | Continuous Clamp Current, V <sub>i</sub> < 0 or V <sub>i</sub> > V <sub>CC</sub> | ±50                          | mA   |
| I <sub>OK</sub>                    | Continuous Clamp Current, V <sub>o</sub> < 0                                     | -50                          | mA   |
| I <sub>CC</sub><br>I <sub>SS</sub> | Continuous Current through each V <sub>CC</sub> or GND                           | ±100                         | mA   |

**NOTES:**

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.
2. V<sub>CC</sub> terminals.
3. All terminals except V<sub>CC</sub>.

### PIN DESCRIPTION

| Pin Names        | Description                               |
|------------------|---|
| $\overline{xOE}$ | 3-State Output Enable Inputs (Active LOW) |
| xAx              | Data Inputs <sup>(1)</sup>                |
| xYx              | 3-State Outputs                           |

**NOTE:**

1. These pins have "Bus-Hold". All other pins are standard inputs, outputs, or I/Os.

### CAPACITANCE (T<sub>A</sub> = +25°C, F = 1.0MHz)

| Symbol           | Parameter <sup>(1)</sup> | Conditions            | Typ. | Max. | Unit |
|------------------|--------------------------|-----------------------|------|------|------|
| C <sub>IN</sub>  | Input Capacitance        | V <sub>IN</sub> = 0V  | 5    | 7    | pF   |
| C <sub>OUT</sub> | Output Capacitance       | V <sub>OUT</sub> = 0V | 7    | 9    | pF   |
| C <sub>I/O</sub> | I/O Port Capacitance     | V <sub>IN</sub> = 0V  | 7    | 9    | pF   |

**NOTE:**

1. As applicable to the device type.

### FUNCTION TABLE (EACH 4-BIT BUFFER)<sup>(1)</sup>

| Inputs           |     | Outputs |
|------------------|-----|---------|
| $\overline{xOE}$ | xAx | xYx     |
| L                | H   | H       |
| L                | L   | L       |
| H                | X   | Z       |

**NOTE:**

1. H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Don't Care  
Z = High Impedance

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

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

| Symbol   | Parameter  | Test Conditions   |                                  | Min. | Typ. <sup>(1)</sup> | Max. | Unit |
|--|--|---|----------------------------------|------|---------------------|------|------|
| V <sub>IH</sub>  | Input HIGH Voltage Level                               | 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>  | Input LOW Voltage Level                                | V <sub>CC</sub> = 2.3V to 2.7V  |                                  | —    | —                   | 0.7  | V    |
|  |  | V <sub>CC</sub> = 2.7V to 3.6V  |                                  | —    | —                   | 0.8  |      |
| I <sub>IH</sub>  | Input HIGH Current                                     | V <sub>CC</sub> = 3.6V  | V <sub>I</sub> = V <sub>CC</sub> | —    | —                   | ±5   | μA   |
| I <sub>IL</sub>  | Input LOW Current                                      | V <sub>CC</sub> = 3.6V  | V <sub>I</sub> = GND             | —    | —                   | ±5   | μA   |
| I <sub>OZH</sub><br>I <sub>OZL</sub>                     | High Impedance Output Current<br>(3-State Output pins) | V <sub>CC</sub> = 3.6V  | V <sub>O</sub> = V <sub>CC</sub> | —    | —                   | ±10  | μA   |
|  |  |   | V <sub>O</sub> = GND             | —    | —                   | ±10  |      |
| V <sub>IK</sub>  | Clamp Diode Voltage                                    | V <sub>CC</sub> = 2.3V, I <sub>IN</sub> = -18mA                             |                                  | —    | -0.7                | -1.2 | V    |
| V <sub>H</sub>   | Input Hysteresis                                       | V <sub>CC</sub> = 3.3V  |                                  | —    | 100                 | —    | mV   |
| I <sub>CC1</sub><br>I <sub>CC2</sub><br>I <sub>CC3</sub> | Quiescent Power Supply Current                         | V <sub>CC</sub> = 3.6V<br>V <sub>IN</sub> = GND or V <sub>CC</sub>          |                                  | —    | 0.1                 | 40   | μA   |
| ΔI <sub>CC</sub>   | Quiescent Power Supply Current Variation               | One input at V <sub>CC</sub> - 0.6V, other inputs at V <sub>CC</sub> or GND |                                  | —    | —                   | 750  | μA   |

**NOTE:**

1. Typical values are at V<sub>CC</sub> = 3.3V, +25°C ambient.

## BUS-HOLD CHARACTERISTICS

| Symbol                                 | Parameter <sup>(1)</sup>         | Test Conditions        |                            | Min. | Typ. <sup>(2)</sup> | Max. | Unit |
|--|----------------------------------|------------------------|----------------------------|------|---------------------|------|------|
| I <sub>BHH</sub><br>I <sub>BHL</sub>   | Bus-Hold Input Sustain Current   | V <sub>CC</sub> = 3V   | V <sub>I</sub> = 2V        | -75  | —                   | —    | μA   |
|  |                                  |                        | V <sub>I</sub> = 0.8V      | 75   | —                   | —    |      |
| I <sub>BHH</sub><br>I <sub>BHL</sub>   | Bus-Hold Input Sustain Current   | V <sub>CC</sub> = 2.3V | V <sub>I</sub> = 1.7V      | -45  | —                   | —    | μA   |
|  |                                  |                        | V <sub>I</sub> = 0.7V      | 45   | —                   | —    |      |
| I <sub>BHHO</sub><br>I <sub>BHLO</sub> | Bus-Hold Input Overdrive Current | V <sub>CC</sub> = 3.6V | V <sub>I</sub> = 0 to 3.6V | —    | —                   | ±500 | μA   |

**NOTES:**

1. Pins with Bus-Hold are identified in the pin description.
2. Typical values are at V<sub>CC</sub> = 3.3V, +25°C ambient.

## OUTPUT DRIVE CHARACTERISTICS

| Symbol | Parameter           | Test Conditions <sup>(1)</sup> |               | Min.      | Max. | Unit |
|--------|---------------------|--------------------------------|---------------|-----------|------|------|
| VOH    | Output HIGH Voltage | VCC = 2.3V to 3.6V             | IOH = - 0.1mA | VCC - 0.2 | —    | V    |
|        |                     | VCC = 2.3V                     | IOH = - 6mA   | 2         | —    |      |
|        |                     | VCC = 2.3V                     | IOH = - 12mA  | 1.7       | —    |      |
|        |                     | VCC = 2.7V                     |               | 2.2       | —    |      |
|        |                     | VCC = 3V                       |               | 2.4       | —    |      |
|        |                     | VCC = 3V                       | IOH = - 24mA  | 2         | —    |      |
| VOL    | Output LOW Voltage  | VCC = 2.3V to 3.6V             | IOH = 0.1mA   | —         | 0.2  | V    |
|        |                     | VCC = 2.3V                     | IOH = 6mA     | —         | 0.4  |      |
|        |                     |                                | IOH = 12mA    | —         | 0.7  |      |
|        |                     | VCC = 2.7V                     | IOH = 12mA    | —         | 0.4  |      |
|        |                     | VCC = 3V                       | IOH = 24mA    | —         | 0.55 |      |

NOTE:  
1. VIH and VIL must be within the min. or max. range shown in the DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE table for the appropriate VCC range. TA = - 40°C to + 85°C.

## OPERATING CHARACTERISTICS, TA = 25°C

| Symbol | Parameter   | Test Conditions     | VCC = 2.5V ± 0.2V | VCC = 3.3V ± 0.3V | Unit |
|--------|---|---------------------|-------------------|-------------------|------|
|        |   |                     | Typical           | Typical           |      |
| CPD    | Power Dissipation Capacitance per Driver Outputs enabled  | CL = 0pF, f = 10Mhz | 32                | 38                | pF   |
| CPD    | Power Dissipation Capacitance per Driver Outputs disabled |                     | 8                 | 10                |      |

## SWITCHING CHARACTERISTICS<sup>(1)</sup>

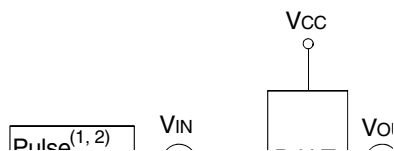
| Symbol | Parameter                  | VCC = 2.5V ± 0.2V |      | VCC = 2.7V |      | VCC = 3.3V ± 0.3V |      | Unit |
|--------|----------------------------|-------------------|------|------------|------|-------------------|------|------|
|        |                            | Min.              | Max. | Min.       | Max. | Min.              | Max. |      |
| tPLH   | Propagation Delay          | 1                 | 3.7  | —          | 3.6  | 1                 | 3    | ns   |
| tPHL   | xAx to xYx                 |                   |      |            |      |                   |      |      |
| tPZH   | Output Enable Time         | 1                 | 5.7  | —          | 5.4  | 1                 | 4.4  | ns   |
| tPZL   | xOE to xYx                 |                   |      |            |      |                   |      |      |
| tPHZ   | Output Disable Time        | 1                 | 5.2  | —          | 4.6  | 1                 | 4.1  | ns   |
| tPLZ   | xOE to xYx                 |                   |      |            |      |                   |      |      |
| tSK(O) | Output Skew <sup>(2)</sup> | —                 | —    | —          | —    | —                 | 500  | ps   |

NOTES:  
1. See TEST CIRCUITS AND WAVEFORMS. TA = - 40°C to + 85°C.  
2. Skew between any two outputs of the same package and switching in the same direction.

## TEST CIRCUITS AND WAVEFORMS

### TEST CONDITIONS

| Symbol            | V <sub>CC</sub> <sup>(1)</sup> = 3.3V±0.3V | V <sub>CC</sub> <sup>(1)</sup> = 2.7V | V <sub>CC</sub> <sup>(2)</sup> = 2.5V±0.2V | Unit |
|-------------------|--|---------------------------------------|--|------|
| V <sub>LOAD</sub> | 6  | 6                                     | 2 x V <sub>CC</sub>                        | V    |
| V <sub>IH</sub>   | 2.7  | 2.7                                   | V <sub>CC</sub>                            | V    |
| V <sub>T</sub>    | 1.5  | 1.5                                   | V <sub>CC</sub> / 2                        | V    |
| V <sub>LZ</sub>   | 300  | 300                                   | 150  | mV   |
| V <sub>HZ</sub>   | 300  | 300                                   | 150  | mV   |
| C <sub>L</sub>    | 50   | 50                                    | 30   | pF   |



*Test Circuit for All Outputs*

#### DEFINITIONS:

C<sub>L</sub> = Load capacitance: includes jig and probe capacitance.  
R<sub>T</sub> = Termination resistance: should be equal to Z<sub>OUT</sub> of the Pulse Generator.

#### NOTES:

1. Pulse Generator for All Pulses: Rate ≤ 1.0MHz; t<sub>r</sub> ≤ 2.5ns; t<sub>r</sub> ≤ 2.5ns.
2. Pulse Generator for All Pulses: Rate ≤ 1.0MHz; t<sub>r</sub> ≤ 2ns; t<sub>r</sub> ≤ 2ns.

### SWITCH POSITION

| Test                                    | Switch            |
|---|-------------------|
| Open Drain<br>Disable Low<br>Enable Low | V <sub>LOAD</sub> |
| Disable High<br>Enable High             | GND               |
| All Other Tests                         | Open              |

#### *Output Skew - t<sub>sk</sub>(x)*

#### NOTES:

1. For t<sub>sk</sub>(o) OUTPUT1 and OUTPUT2 are any two outputs.
2. For t<sub>sk</sub>(b) OUTPUT1 and OUTPUT2 are in the same bank.

*Propagation Delay*

#### *Enable and Disable Times*

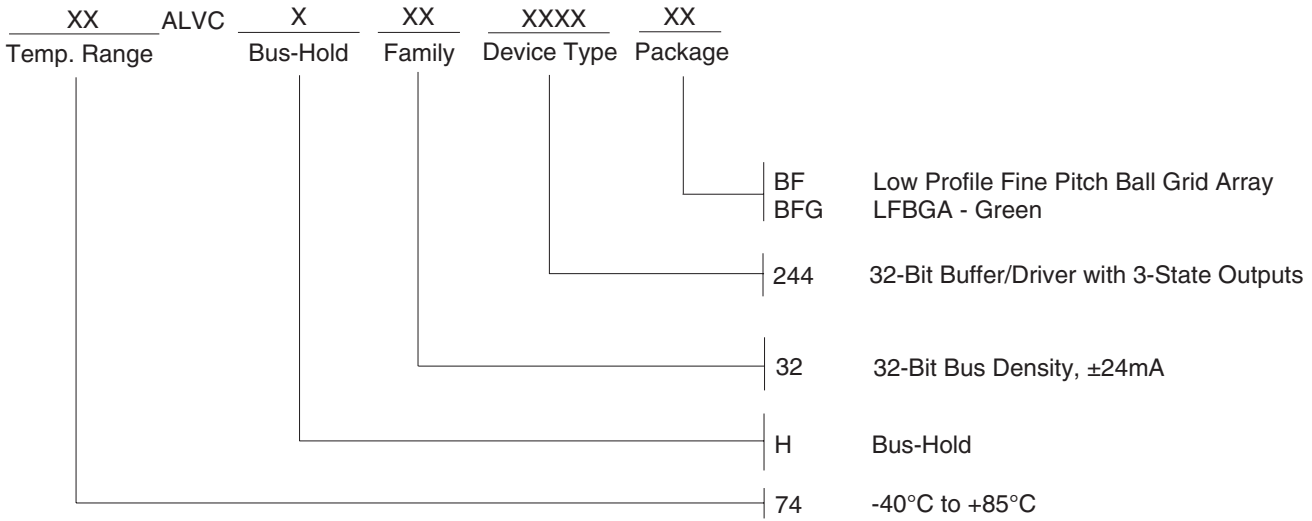
#### NOTE:

1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.

*Set-up, Hold, and Release Times*

*Pulse Width*

**ORDERING INFORMATION**



**CORPORATE HEADQUARTERS**  
 6024 Silver Creek Valley Road  
 San Jose, CA 95138

**for SALES:**  
 800-345-7015 or 408-284-8200  
 fax: 408-284-2775  
 www.idt.com

**for Tech Support:**  
 logichelp@idt.com