



# 3.3V CMOS 1-BIT TO 4-BIT ADDRESS DRIVER WITH 3-STATE OUTPUTS AND BUS-HOLD

**IDT74ALVCH162344**

## 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 (0.4 $\mu$  W typ. static)
- Rail-to-Rail output swing for increased noise margin
- Available in SSOP, TSSOP, and TVSOP packages

## DRIVE FEATURES:

- Balanced Output Drivers:  $\pm 12mA$
- Low switching noise

## DESCRIPTION:

This 1-bit to 4-bit address driver is built using advanced dual metal CMOS technology. The ALVCH162344 device is used in applications in which four separate memory locations must be addressed by a single address.

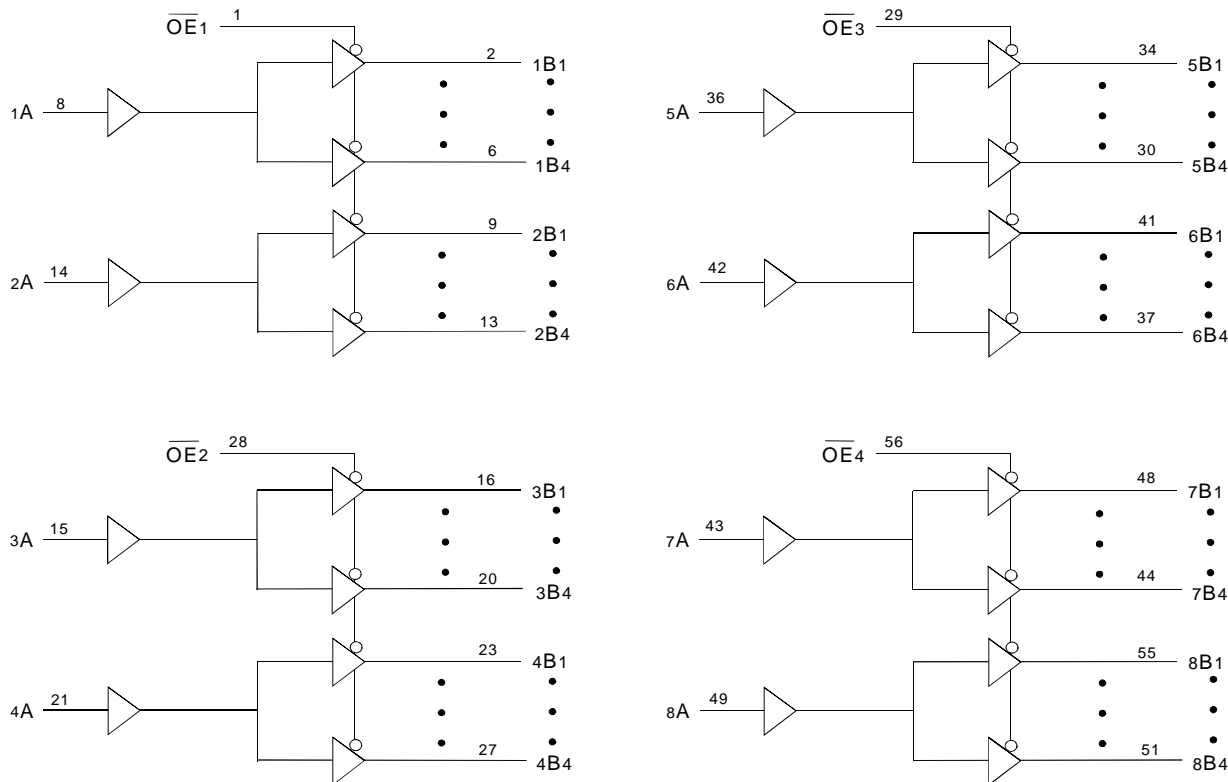
The ALVCH162344 has series resistors in the device output structure which will significantly reduce line noise when used with light loads. This driver has been designed to drive  $\pm 12mA$  at the designated threshold levels.

The ALVCH162344 has "bus-hold" which retains the inputs' last state whenever the input goes to a high-impedance. This prevents floating inputs and eliminates the need for pull-up/down resistors.

## APPLICATIONS:

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

## FUNCTIONAL BLOCK DIAGRAM

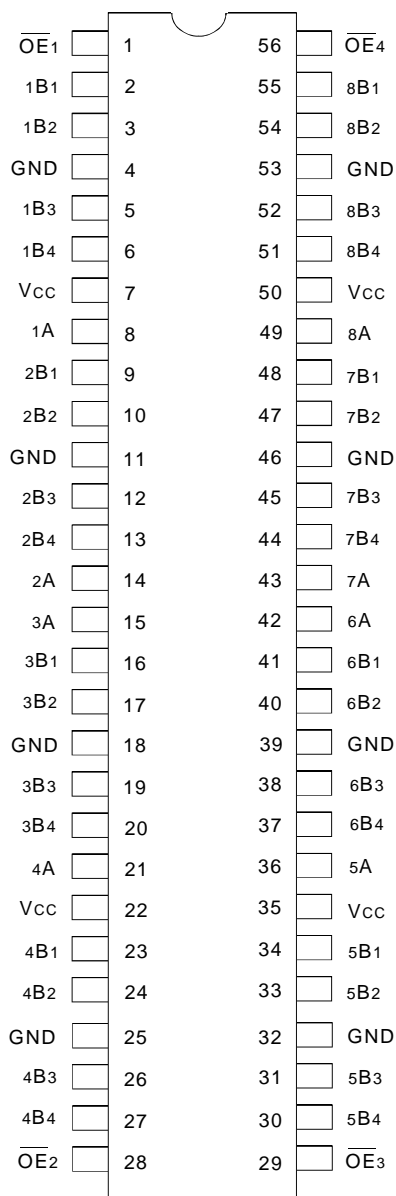


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INDUSTRIAL TEMPERATURE RANGE

MARCH 1999

## PIN CONFIGURATION

SSOP/ TSSOP/ TVSOP  
TOP VIEWABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

Symbol	Description	Max	Unit
VTERM <sup>(2)</sup>	Terminal Voltage with Respect to GND	-0.5 to +4.6	V
VTERM <sup>(3)</sup>	Terminal Voltage with Respect to GND	-0.5 to V <sub>CC</sub> +0.5	V
TSTG	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> I <sub>SS</sub>	Continuous Current through each V <sub>CC</sub> or GND	±100	mA

## NOTES:

- 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.
- V<sub>CC</sub> terminals.
- All terminals except V<sub>CC</sub>.

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:

- As applicable to the device type.

## PIN DESCRIPTION

Pin Names	Description
$\overline{OE}_x$	3-State Output Enable Inputs (Active LOW)
xA	Data Inputs <sup>(1)</sup>
xBx	3-State Outputs

## NOTE:

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

FUNCTION TABLE<sup>(1)</sup>

Inputs		Outputs
$\overline{OE}_x$	xA	xBx
L	L	L
L	H	H
H	X	Z

## NOTE:

- H = HIGH Voltage Level  
X = Don't Care  
L = LOW Voltage Level  
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> I <sub>OZL</sub>	High Impedance Output Current (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> I <sub>CC2</sub> I <sub>CC3</sub>	Quiescent Power Supply Current	V <sub>CC</sub> = 3.6V 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> 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> 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> 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
V <sub>OH</sub>	Output HIGH Voltage	V <sub>CC</sub> = 2.3V to 3.6V	I <sub>OH</sub> = - 0.1mA	V <sub>CC</sub> - 0.2	—	V
		V <sub>CC</sub> = 2.3V	I <sub>OH</sub> = - 4mA	1.9	—	
			I <sub>OH</sub> = - 6mA	1.7	—	
		V <sub>CC</sub> = 2.7V	I <sub>OH</sub> = - 4mA	2.2	—	
			I <sub>OH</sub> = - 8mA	2	—	
		V <sub>CC</sub> = 3V	I <sub>OH</sub> = - 6mA	2.4	—	
I <sub>OH</sub> = - 12mA	2		—			
V <sub>OL</sub>	Output LOW Voltage	V <sub>CC</sub> = 2.3V to 3.6V	I <sub>OL</sub> = 0.1mA	—	0.2	V
		V <sub>CC</sub> = 2.3V	I <sub>OL</sub> = 4mA	—	0.4	
			I <sub>OL</sub> = 6mA	—	0.55	
		V <sub>CC</sub> = 2.7V	I <sub>OL</sub> = 4mA	—	0.4	
			I <sub>OL</sub> = 8mA	—	0.6	
		V <sub>CC</sub> = 3V	I <sub>OL</sub> = 6mA	—	0.55	
I <sub>OL</sub> = 12mA	—		0.8			

**NOTE:**  
 1. V<sub>IH</sub> and V<sub>IL</sub> must be within the min. or max. range shown in the DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE table for the appropriate V<sub>CC</sub> range. T<sub>A</sub> = - 40°C to + 85°C.

OPERATING CHARACTERISTICS, T<sub>A</sub> = 25°C

Symbol	Parameter	Test Conditions	V <sub>CC</sub> = 2.5V ± 0.2V	V <sub>CC</sub> = 3.3V ± 0.3V	Unit
			Typical	Typical	
CPD	Power Dissipation Capacitance Outputs enabled	C <sub>L</sub> = 0pF, f = 10MHz	68	82	pF
CPD	Power Dissipation Capacitance Outputs disabled		12	14	

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

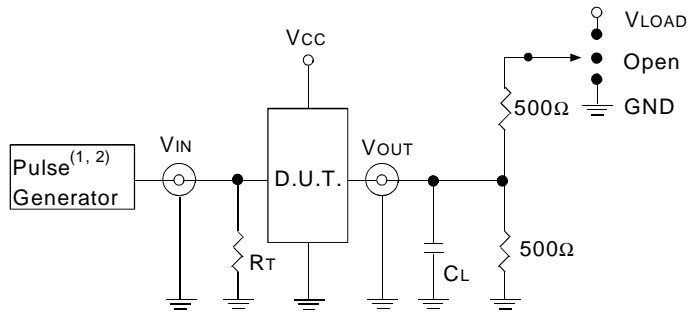
Symbol	Parameter	V <sub>CC</sub> = 2.5V ± 0.2V		V <sub>CC</sub> = 2.7V		V <sub>CC</sub> = 3.3V ± 0.3V		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
t <sub>PLH</sub>	Propagation Delay	1	4.9	—	5.1	1.4	4.4	ns
t <sub>PHL</sub>	x <sub>A</sub> to x <sub>Bx</sub>							
t <sub>PZH</sub>	Output Enable Time	1	6.4	—	6.6	1.2	5.7	ns
t <sub>PZL</sub>	$\overline{\text{OE}}$ to x <sub>Bx</sub>							
t <sub>PHZ</sub>	Output Disable Time	1	5.4	—	4.7	1.2	4.5	ns
t <sub>PLZ</sub>	$\overline{\text{OE}}$ to x <sub>Bx</sub>							
t <sub>SK(O)</sub>	Output Skew <sup>(2)</sup>	—	—	—	—	—	500	ps
t <sub>SK(b)</sub>	Output Skew <sup>(2)</sup>	—	—	—	—	—	350	ps

**NOTES:**  
 1. See TEST CIRCUITS AND WAVEFORMS. T<sub>A</sub> = - 40°C to + 85°C.  
 2. Skew between any two outputs of the same package and switching in the same direction. For t<sub>SK(O)</sub>, OUTPUT1 and OUTPUT2 are any two outputs. For t<sub>SK(b)</sub>, OUTPUT1 and OUTPUT2 are in the same bank of the same package; this parameter is guaranteed but not production tested.

## 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:

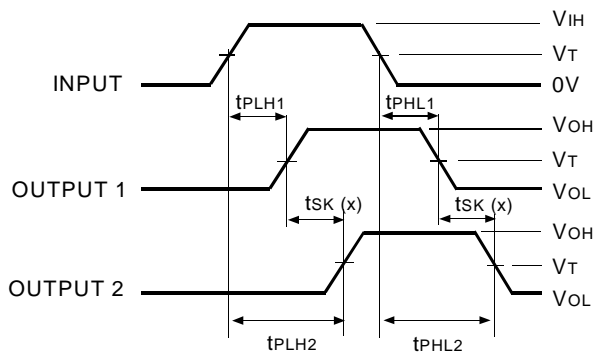
C<sub>L</sub> = Load capacitance: includes jig and probe capacitance.  
R<sub>T</sub> = Termination resistance: should be equal to Z<sub>OUT</sub> of the Pulse Generator.

#### 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 Disable Low Enable Low	V <sub>LOAD</sub>
Disable High Enable High	GND
All Other Tests	Open

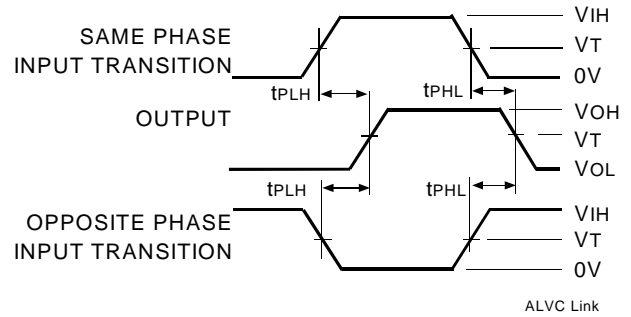


$$tsk(x) = |t_{PLH2} - t_{PLH1}| \text{ or } |t_{PHL2} - t_{PHL1}|$$

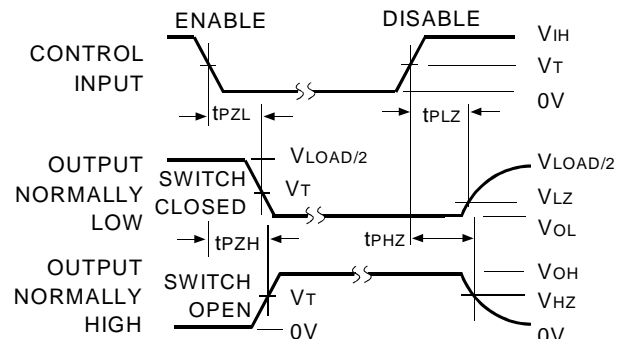
Output Skew - tsk(x)

#### NOTES:

1. For tsk(o) OUTPUT1 and OUTPUT2 are any two outputs.
2. For tsk(b) OUTPUT1 and OUTPUT2 are in the same bank.



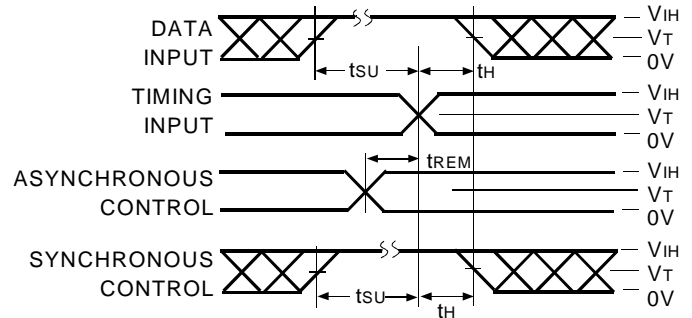
Propagation Delay



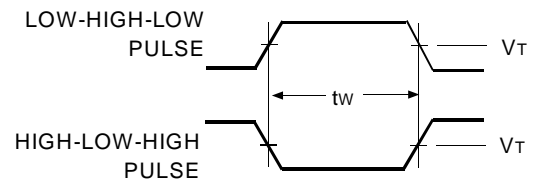
Enable and Disable Times

#### NOTE:

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



Set-up, Hold, and Release Times



Pulse Width

## ORDERING INFORMATION

IDT	XX	ALVC	X	XX	XXX	XX	
Temp. Range	Bus-Hold	Family	Device Type	Package			
							PV Shrink Small Outline Package
							PA Thin Shrink Small Outline Package
							PF Thin Very Small Outline Package
							344 1-Bit to 4-Bit Address Driver with 3-State Outputs
							162 Double-Density with Resistors, ±12mA
							H Bus-Hold
							74 -40°C to +85°C



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