

# DATA SHEET

## **74ALVC16244/74ALVCH16244** 2.5V/3.3V 16-bit buffer/line driver (3-State)

Product specification  
Supersedes data of 1997 Mar 21  
IC24 Data Handbook

1998 Jun 29

## 16-bit buffer/line driver (3-State)

74ALVC16244/  
74ALVCH16244

## FEATURES

- Wide supply voltage range of 1.2V to 3.6V
- Complies with JEDEC standard no. 8-1A
- CMOS low power consumption
- MULTIBYTE™ flow-through standard pin-out architecture
- Low inductance multiple  $V_{CC}$  and GND pins for minimum noise and ground bounce
- Direct interface with TTL levels
- Bus hold on data inputs (74ALVCH16244 only)
- Output drive capability 50Ω transmission lines @ 85°C
- Current drive  $\pm 24$  mA at 3.0 V

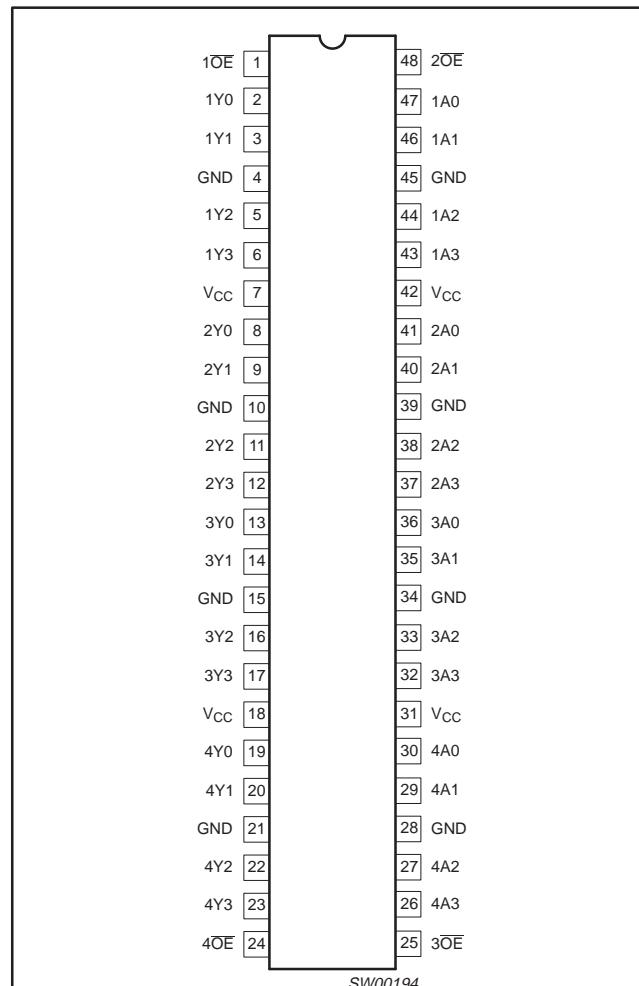
## DESCRIPTION

The 74ALVC16244(74ALVCH16244) is a 16-bit non-inverting buffer/line driver with 3-State outputs. The device can be used as four 4-bit buffers, two 8-bit buffers or one 16-bit buffer. The 3-State outputs are controlled by the output enable inputs  $1OE$  and  $2OE$ . A HIGH on  $nOE$  causes the outputs to assume a high impedance OFF-state.

The 74ALVCH16244 has active bus hold circuitry which is provided to hold unused or floating data inputs at a valid logic level. This feature eliminates the need for external pull-up or pull-down resistors.

The 74ALVC16244 has 5V tolerant inputs.

## PIN CONFIGURATION



SW00194

## QUICK REFERENCE DATA

$GND = 0$  V;  $T_{amb} = 25^\circ\text{C}$ ;  $t_r = t_f \leq 2.5$  ns

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT
$t_{PHL}/t_{PLH}$	Propagation delay An to $Y_n$	$V_{CC} = 2.5$ V, $CL = 30$ pF $V_{CC} = 3.3$ V, $CL = 50$ pF	1.9 1.9	ns
$C_I$	Input capacitance		5.0	pF
$C_{PD}$	Power dissipation capacitance per buffer	$V_I = GND$ to $V_{CC}^1$	Outputs enabled Outputs disabled	25 4 pF

## NOTE:

1.  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ):  

$$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$$
 where:  $f_i$  = input frequency in MHz;  $C_L$  = output load capacitance in pF;  
 $f_o$  = output frequency in MHz;  $V_{CC}$  = supply voltage in V;  $\sum (C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs.

## ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	DWG NUMBER
48-Pin Plastic SSOP Type III	$-40^\circ\text{C}$ to $+85^\circ\text{C}$	74ALVC16244 DL	AC16244 DL	SOT370-1
48-Pin Plastic TSSOP Type II	$-40^\circ\text{C}$ to $+85^\circ\text{C}$	74ALVC16244 DGG	AC16244 DGG	SOT362-1
48-Pin Plastic SSOP Type III	$-40^\circ\text{C}$ to $+85^\circ\text{C}$	74ALVCH16244 DL	ACH16244 DL	SOT370-1
48-Pin Plastic TSSOP Type II	$-40^\circ\text{C}$ to $+85^\circ\text{C}$	74ALVCH16244 DGG	ACH16244 DGG	SOT362-1

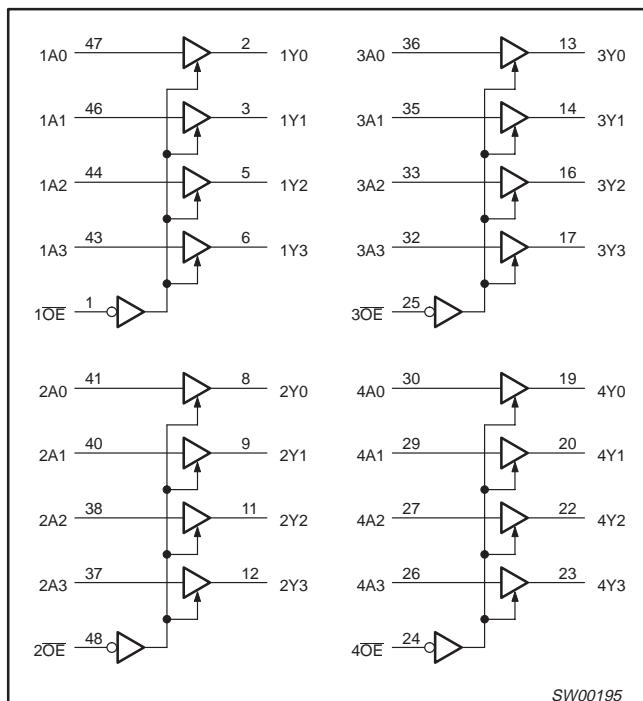
## 16-bit buffer/line driver (3-State)

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## PIN DESCRIPTION

PIN NUMBER	SYMBOL	NAME AND FUNCTION
1	$1\overline{OE}$	Output enable input (active LOW)
2, 3, 5, 6	1Y0 to 1Y3	Data outputs
4, 10, 15, 21, 28, 34, 39, 45	GND	Ground (0V)
7, 18, 31, 42	$V_{CC}$	Positive supply voltage
8, 9, 11, 12	2Y0 to 2Y3	Data outputs
13, 14, 16, 17	3Y0 to 3Y3	Data outputs
19, 20, 22, 23	4Y0 to 4Y3	Data outputs
24	$4\overline{OE}$	Output enable input (active LOW)
25	$3\overline{OE}$	Output enable input (active LOW)
30, 29, 27, 26	4A0 to 4A3	Data inputs
36, 35, 33, 32	3A0 to 3A3	Data inputs
41, 40, 38, 37	2A0 to 2A3	Data inputs
47, 46, 44, 43	1A0 to 1A3	Data inputs
48	$2\overline{OE}$	Output enable input (active LOW)

## LOGIC SYMBOL



## FUNCTION TABLE

INPUTS		OUTPUT
$n\overline{OE}$	$nAn$	$nYn$
L	L	L
L	H	H
H	X	Z

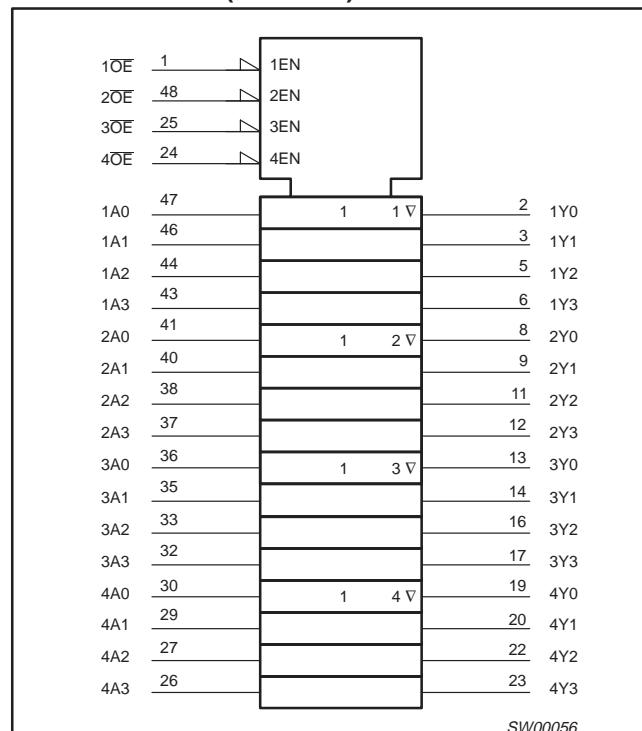
H = HIGH voltage level

L = LOW voltage level

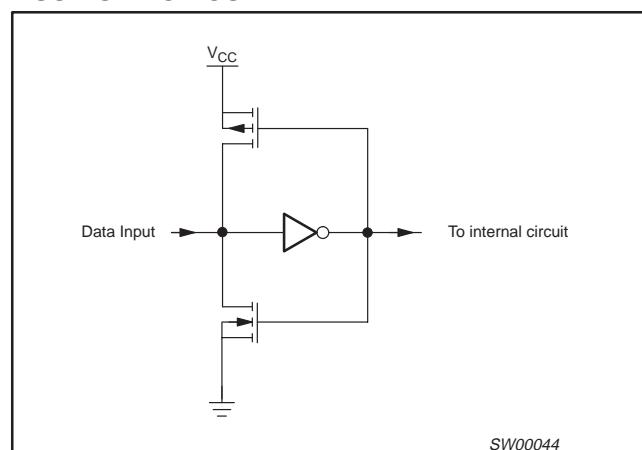
X = don't care

Z = high impedance OFF-state

## LOGIC SYMBOL (IEEE/IEC)



## BUS HOLD CIRCUIT



## 16-bit buffer/line driver (3-State)

74ALVC16244/  
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## RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	LIMITS		UNIT
			MIN	MAX	
V <sub>CC</sub>	DC supply voltage 2.5V range (for max. speed performance @ 30 pF output load)		2.3	2.7	V
	DC supply voltage 3.3V range (for max. speed performance @ 50 pF output load)		3.0	3.6	
	DC supply voltage (for low-voltage applications)		1.2	3.6	
V <sub>I</sub>	DC Input voltage range	For data input pins with bus hold	0	V <sub>CC</sub>	V
		For data input pins without bus hold	0	5.5	
		For control pins	0	5.5	
V <sub>O</sub>	DC output voltage range		0	V <sub>CC</sub>	V
T <sub>amb</sub>	Operating free-air temperature range		-40	+85	°C
t <sub>r</sub> , t <sub>f</sub>	Input rise and fall times	V <sub>CC</sub> = 2.3 to 3.0V V <sub>CC</sub> = 3.0 to 3.6V	0 0	20 10	ns/V

ABSOLUTE MAXIMUM RATINGS<sup>1</sup>

In accordance with the Absolute Maximum Rating System (IEC 134)

Voltages are referenced to GND (ground = 0V)

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V <sub>CC</sub>	DC supply voltage		-0.5 to +4.6	V
I <sub>IK</sub>	DC input diode current	V <sub>I</sub> < 0	-50	mA
V <sub>I</sub>	DC input voltage	For data inputs with bus hold <sup>2</sup>	-0.5 to V <sub>CC</sub> +0.5	V
		For data inputs without bus hold <sup>2</sup>	-0.5 to +5.5	
		For control pins <sup>2</sup>	-0.5 to +5.5	
I <sub>OK</sub>	DC output diode current	V <sub>O</sub> > V <sub>CC</sub> or V <sub>O</sub> < 0	± 50	mA
V <sub>O</sub>	DC output voltage	Note 2	-0.5 to V <sub>CC</sub> +0.5	V
I <sub>O</sub>	DC output source or sink current	V <sub>O</sub> = 0 to V <sub>CC</sub>	± 50	mA
I <sub>GND</sub> , I <sub>CC</sub>	DC V <sub>CC</sub> or GND current		± 100	mA
T <sub>stg</sub>	Storage temperature range		-65 to +150	°C
P <sub>TOT</sub>	Power dissipation per package -plastic medium-shrink (SSOP) -plastic thin-medium-shrink (TSSOP)	For temperature range: -40 to +125 °C above +55°C derate linearly with 11.3 mW/K above +55°C derate linearly with 8 mW/K	850 600	mW

## NOTES:

1. Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
2. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

## 16-bit buffer/line driver (3-State)

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74ALVCH16244

## DC CHARACTERISTICS

Over recommended operating conditions. Voltage are referenced to GND (ground = 0 V).

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT	
			Temp = -40°C to +85°C				
			MIN	TYP <sup>1</sup>	MAX		
V <sub>IH</sub>	HIGH level Input voltage	V <sub>CC</sub> = 1.2V	V <sub>CC</sub>			V	
		V <sub>CC</sub> = 1.8V	0.7*V <sub>CC</sub>	0.9			
		V <sub>CC</sub> = 2.3 to 2.7V	1.7	1.2			
		V <sub>CC</sub> = 2.7 to 3.6V	2.0	1.5			
V <sub>IL</sub>	LOW level Input voltage	V <sub>CC</sub> = 1.2V			GND	V	
		V <sub>CC</sub> = 1.8V		0.9	0.2*V <sub>CC</sub>		
		V <sub>CC</sub> = 2.3 to 2.7V		1.2	0.7		
		V <sub>CC</sub> = 2.7 to 3.6V		1.5	0.8		
V <sub>OH</sub>	HIGH level output voltage	V <sub>CC</sub> = 1.8 to 3.6V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -100µA	V <sub>CC</sub> -0.2	V <sub>CC</sub>		V	
		V <sub>CC</sub> = 1.8V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -6mA	V <sub>CC</sub> -0.4	V <sub>CC</sub> -0.10			
		V <sub>CC</sub> = 2.3V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -6mA	V <sub>CC</sub> -0.3	V <sub>CC</sub> -0.08			
		V <sub>CC</sub> = 2.3V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -12mA	V <sub>CC</sub> -0.5	V <sub>CC</sub> -0.17			
		V <sub>CC</sub> = 2.3V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -18mA	V <sub>CC</sub> -0.6	V <sub>CC</sub> -0.26			
		V <sub>CC</sub> = 2.7V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -12mA	V <sub>CC</sub> -0.5	V <sub>CC</sub> -0.14			
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -24mA	V <sub>CC</sub> -1.0	V <sub>CC</sub> -0.28			
V <sub>OL</sub>	LOW level output voltage	V <sub>CC</sub> = 1.8 to 3.6V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 100µA		GND	0.20	V	
		V <sub>CC</sub> = 1.8V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 6mA		0.09	0.30		
		V <sub>CC</sub> = 2.3V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 6mA		0.07	0.20		
		V <sub>CC</sub> = 2.3V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 12mA		0.15	0.40		
		V <sub>CC</sub> = 2.3V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 18mA		0.23	0.60		
		V <sub>CC</sub> = 2.7V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 12mA		0.14	0.40		
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 24mA		0.27	0.55		
I <sub>I</sub>	Input leakage current per data pin with bus hold	V <sub>CC</sub> = 1.8 to 3.6V; V <sub>I</sub> = V <sub>CC</sub> or GND		0.1	5	µA	
	Input leakage current per data pin without bus hold	V <sub>CC</sub> = 1.8 to 3.6V; V <sub>I</sub> = 5.5 V or GND		0.1	5		
	Input leakage current per control pin	V <sub>CC</sub> = 1.8 to 3.6V; V <sub>I</sub> = 5.5 V or GND		0.1	5		
I <sub>IHZ</sub> /I <sub>ILZ</sub>	Input current for common I/O pins	V <sub>CC</sub> = 1.8 to 2.7V; V <sub>I</sub> = V <sub>CC</sub> or GND		0.1	10	µA	
		V <sub>CC</sub> = 3.6V; V <sub>I</sub> = V <sub>CC</sub> or GND		0.1	15		
I <sub>OZ</sub>	3-State output OFF-state current	V <sub>CC</sub> = 1.8 to 2.7V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND		0.1	5	µA	
		V <sub>CC</sub> = 2.7 to 3.6V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND		0.1	10		
I <sub>CC</sub>	Quiescent supply current	V <sub>CC</sub> = 1.8 to 2.7V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0		0.1	20	µA	
		V <sub>CC</sub> = 2.3 to 3.6V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0		0.2	40		
ΔI <sub>CC</sub>	Additional quiescent supply current given per data I/O pin with bus hold	V <sub>CC</sub> = 2.7V to 3.6V; V <sub>I</sub> = V <sub>CC</sub> - 0.6V; I <sub>O</sub> = 0		150	750	µA	
	Additional quiescent supply current given per data I/O pin without bus hold			5	500		
	Additional quiescent supply current given per control pin			5	500		

## 16-bit buffer/line driver (3-State)

74ALVC16244/  
74ALVCH16244

## DC ELECTRICAL CHARACTERISTICS (Continued)

Over recommended operating conditions. Voltage are referenced to GND (ground = 0 V).

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT	
			Temp = -40°C to +85°C				
			MIN	TYP <sup>1</sup>	MAX		
I <sub>BHL</sub> <sup>2</sup>	Bus hold LOW sustaining current	V <sub>CC</sub> = 2.3V; V <sub>I</sub> = 0.7V	45	—		μA	
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = 0.8V	75	150			
I <sub>BHH</sub> <sup>2</sup>	Bus hold HIGH sustaining current	V <sub>CC</sub> = 2.3V; V <sub>I</sub> = 1.7V	-45			μA	
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = 2.0V	-75	-175			
I <sub>BHLO</sub> <sup>2</sup>	Bus hold LOW overdrive current	V <sub>CC</sub> = 2.7V	300			μA	
		V <sub>CC</sub> = 3.6V	450				
I <sub>BHHO</sub> <sup>2</sup>	Bus hold HIGH overdrive current	V <sub>CC</sub> = 2.7V	-300			μA	
		V <sub>CC</sub> = 3.6V	-450				

## NOTES:

1. All typical values are at T<sub>amb</sub> = 25°C.
2. Valid for data inputs of bus hold parts.

AC CHARACTERISTICS FOR V<sub>CC</sub> = 2.3V TO 2.7V RANGE AND V<sub>CC</sub> < 2.3VGND = 0V; t<sub>r</sub> = t<sub>f</sub> ≤ 2.0ns; C<sub>L</sub> = 30pF

SYMBOL	PARAMETER	WAVEFORM	LIMITS						UNIT	
			V <sub>CC</sub> = 2.3 to 2.7V			V <sub>CC</sub> = 1.8V				
			MIN	TYP <sup>1, 2</sup>	MAX	MIN	TYP <sup>1</sup>	MAX		
t <sub>PHL</sub> /t <sub>PLH</sub>	Propagation delay nAn to nYn	1, 3	1.0	1.9	3.7	1.5	2.8	5.1	5.8	ns
t <sub>PZH</sub> /t <sub>PZL</sub>	3-State output enable time nOE to nYn	2, 3	1.0	2.5	4.9	1.5	3.8	7.1	8.4	ns
t <sub>PHZ</sub> /t <sub>PLZ</sub>	3-State output disable time nOE to nYn	2, 3	1.0	2.1	4.1	1.5	3.1	3.5	5.9	ns

## NOTES:

1. All typical values are measured at T<sub>amb</sub> = 25°C.
2. Typical value is measured at V<sub>CC</sub> = 2.5V

AC CHARACTERISTICS FOR V<sub>CC</sub> = 3.0V TO 3.6V RANGE AND V<sub>CC</sub> = 2.7VGND = 0V; t<sub>r</sub> = t<sub>f</sub> ≤ 2.5ns; C<sub>L</sub> = 50pF

SYMBOL	PARAMETER	WAVEFORM	LIMITS						UNIT	
			V <sub>CC</sub> = 3.3 ± 0.3V			V <sub>CC</sub> = 2.7V				
			MIN	TYP <sup>1, 2</sup>	MAX	MIN	TYP <sup>1</sup>	MAX		
t <sub>PHL</sub> /t <sub>PLH</sub>	Propagation delay nAn to nYn	1, 3	1.0	1.9	3.0	1.0	2.1	3.6	ns	
t <sub>PZH</sub> /t <sub>PZL</sub>	3-State output enable time nOE to nYn	2, 3	1.0	2.3	4.0	1.0	2.9	4.9	ns	
t <sub>PHZ</sub> /t <sub>PLZ</sub>	3-State output disable time nOE to nYn	2, 3	1.0	2.7	4.1	1.0	3.0	4.5	ns	

## NOTES:

1. All typical values are measured at T<sub>amb</sub> = 25°C.
2. Typical value is measured at V<sub>CC</sub> = 3.3V

## 16-bit buffer/line driver (3-State)

74ALVC16244/  
74ALVCH16244AC WAVEFORMS FOR  $V_{CC} = 2.3V$  TO  $2.7V$  AND  
 $V_{CC} < 2.3V$  RANGE

$V_M = 0.5 V_{CC}$

$V_X = V_{OL} + 0.15V$

$V_Y = V_{OH} - 0.15V$

 $V_{OL}$  and  $V_{OH}$  are the typical output voltage drop that occur with the output load.

$V_I = V_{CC}$

AC WAVEFORMS FOR  $V_{CC} = 3.0V$  TO  $3.6V$  AND  
 $V_{CC} = 2.7V$  RANGE

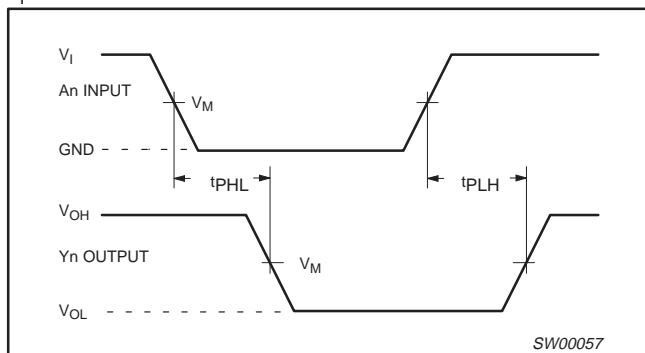
$V_M = 1.5 V$

$V_X = V_{OL} + 0.3V$

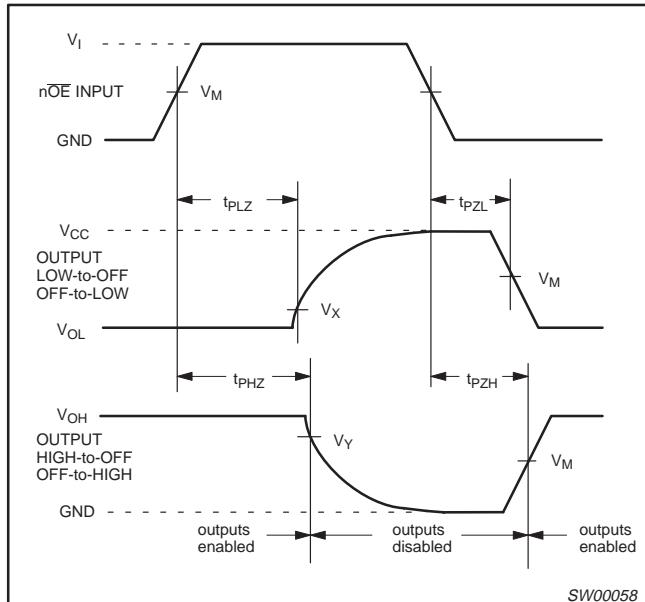
$V_Y = V_{OH} - 0.3V$

 $V_{OL}$  and  $V_{OH}$  are the typical output voltage drop that occur with the output load.

$V_I = 2.7V$

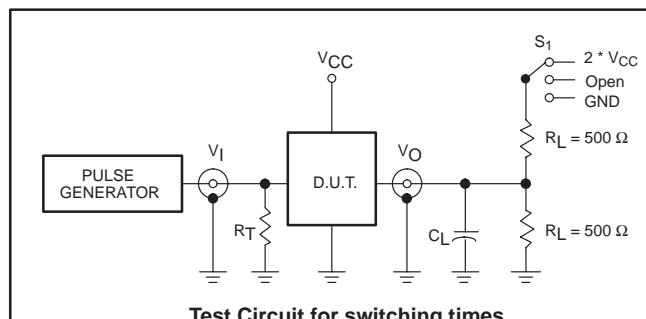


Waveform 1. Input (An) to output (Yn) propagation delay times



Waveform 2. 3-State enable and disable times

## TEST CIRCUIT



Test Circuit for switching times

## DEFINITIONS

 $R_L$  = Load resistor $C_L$  = Load capacitance includes jig and probe capacitance $R_T$  = Termination resistance should be equal to  $Z_{OUT}$  of pulse generators.

## SWITCH POSITION

TEST	S <sub>1</sub>
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	$2 * V_{CC}$
$t_{PHZ}/t_{PZH}$	GND

V <sub>CC</sub>	V <sub>I</sub>
< 2.7V	$V_{CC}$
2.7–3.6V	2.7V

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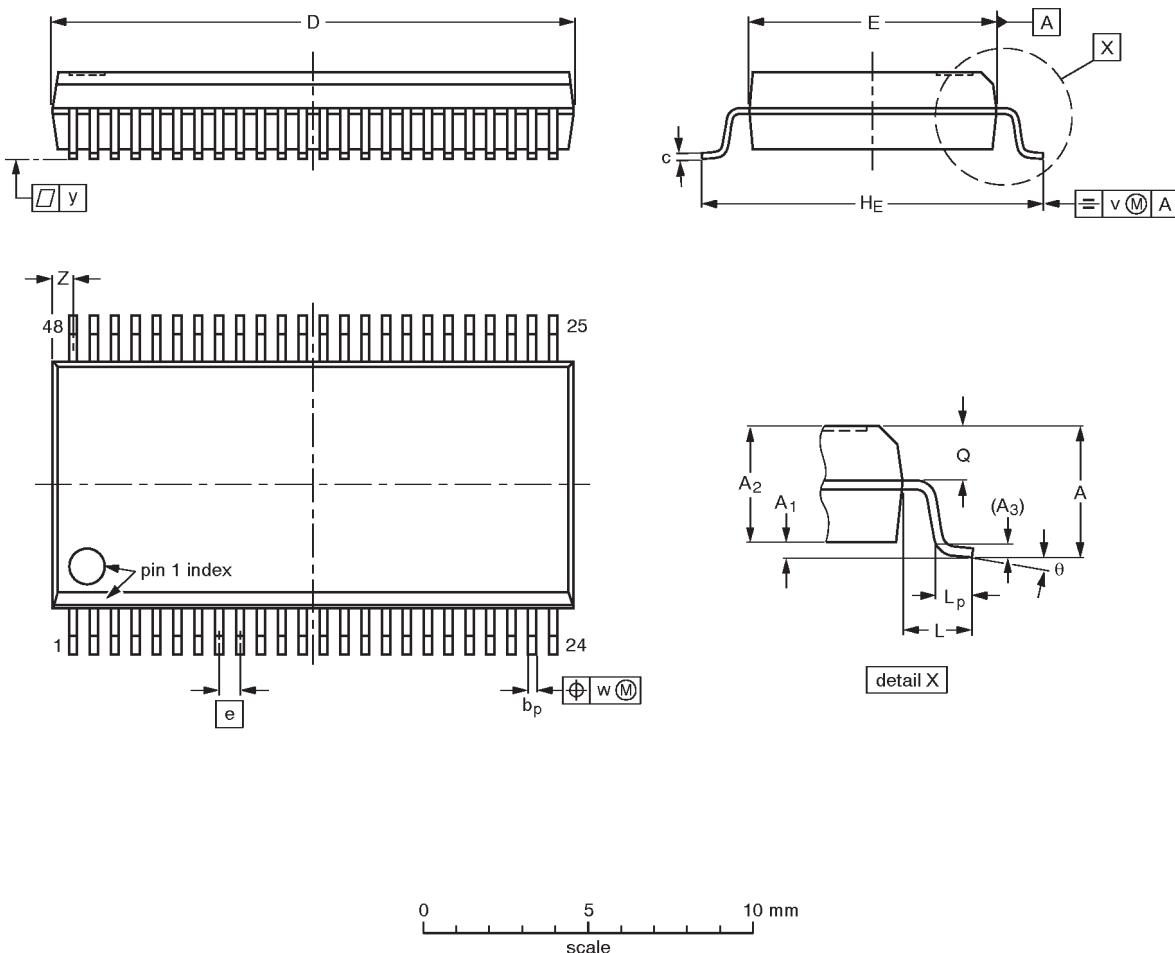
Waveform 3. Load circuitry for switching times

## 2.5V/3.3V 16-bit buffer/line driver (3-State)

74ALVC16244/  
74ALVCH16244

SSOP48: plastic shrink small outline package; 48 leads; body width 7.5 mm

SOT370-1



## DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	2.8 0.2	0.4 0.2	2.35 2.20	0.25	0.3 0.2	0.22 0.13	16.00 15.75	7.6 7.4	0.635	10.4 10.1	1.4	1.0 0.6	1.2 1.0	0.25	0.18	0.1	0.85 0.40	8° 0°

## Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

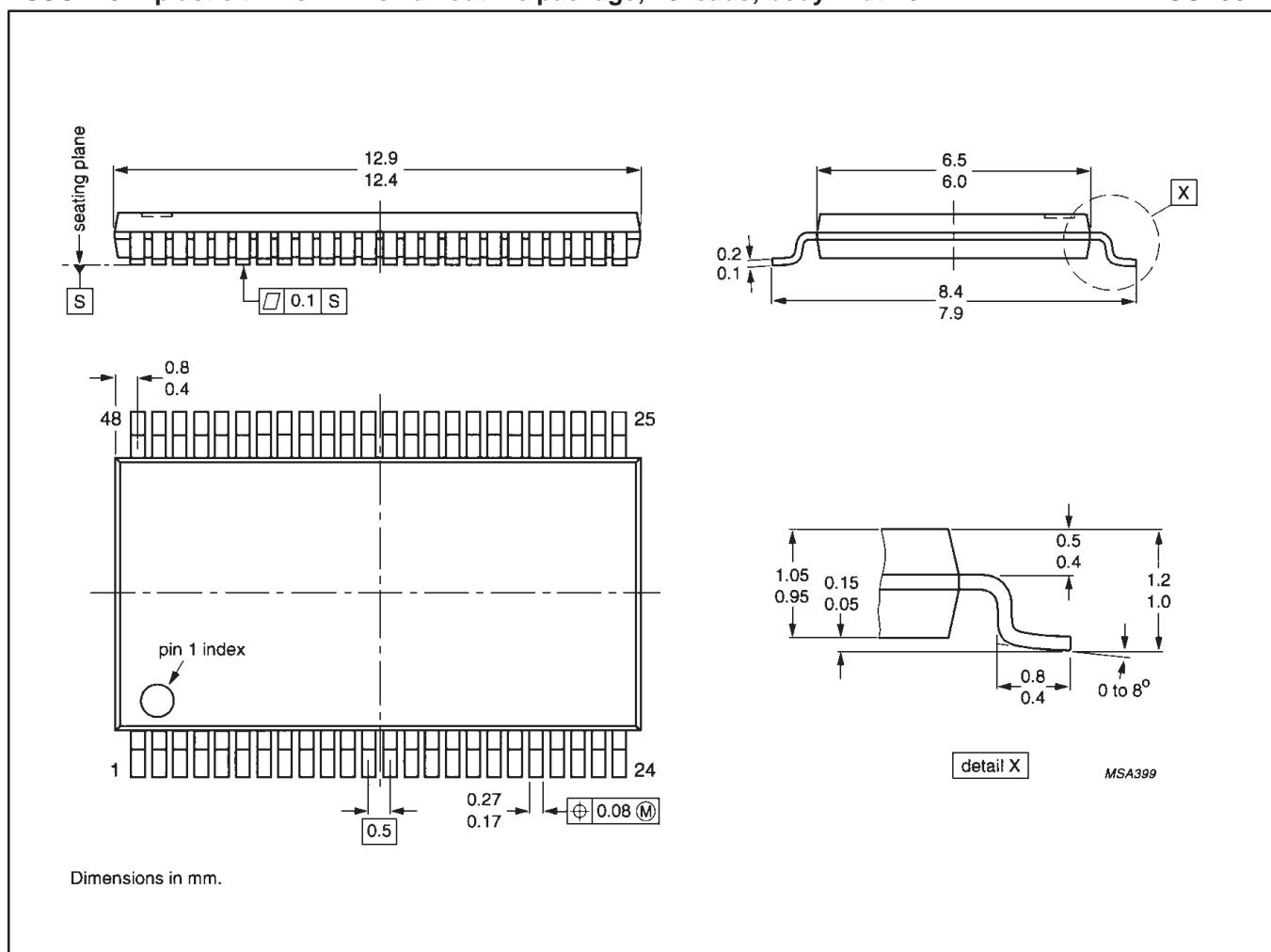
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT370-1		MO-118AA				93-11-02 95-02-04

## 2.5V/3.3V 16-bit buffer/line driver (3-State)

74ALVC16244/  
74ALVCH16244

TSSOP48: plastic thin shrink small outline package; 48 leads; body width 6.1mm

SOT362-1



2.5V/3.3V 16-bit buffer/line driver (3-State)

74ALVC16244/  
74ALVCH16244

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**DEFINITIONS**

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Data Sheet Identification	Product Status	Definition
<i>Objective Specification</i>	<b>Formative or in Design</b>	This data sheet contains the design target or goal specifications for product development. Specifications may change in any manner without notice.
<i>Preliminary Specification</i>	<b>Preproduction Product</b>	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
<i>Product Specification</i>	<b>Full Production</b>	This data sheet contains Final Specifications. Philips Semiconductors reserves the right to make changes at any time without notice, in order to improve design and supply the best possible product.

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