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Kind regards,

Team Nexperia

# DATA SHEET

**74ALVT16244**

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

Product specification  
Supersedes data of 1998 Feb 13  
IC23 Data Handbook

1998 Oct 07

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

# 74ALVT16244

## FEATURES

- 16-bit bus interface
- 5V I/O compatible
- 3-State buffers
- Output capability: +64mA/-32mA
- TTL input and output switching levels
- Input and output interface capability to systems at 5V supply
- Bus-hold data inputs eliminate the need for external pull-up resistors to hold unused inputs
- Live insertion/extraction permitted
- Power-up 3-State
- No bus current loading when output is tied to 5V bus
- Latch-up protection exceeds 500mA per JEDEC Std 17
- ESD protection exceeds 2000V per MIL STD 883 Method 3015 and 200V per Machine Model

## DESCRIPTION

The 74ALVT16244 is a high-performance BiCMOS product designed for  $V_{CC}$  operation at 2.5V or 3.3V with I/O compatibility up to 5V.

This device is a 16-bit buffer and line driver featuring non-inverting 3-State bus outputs. The device can be used as four 4-bit buffers, two 8-bit buffers, or one 16-bit buffer.

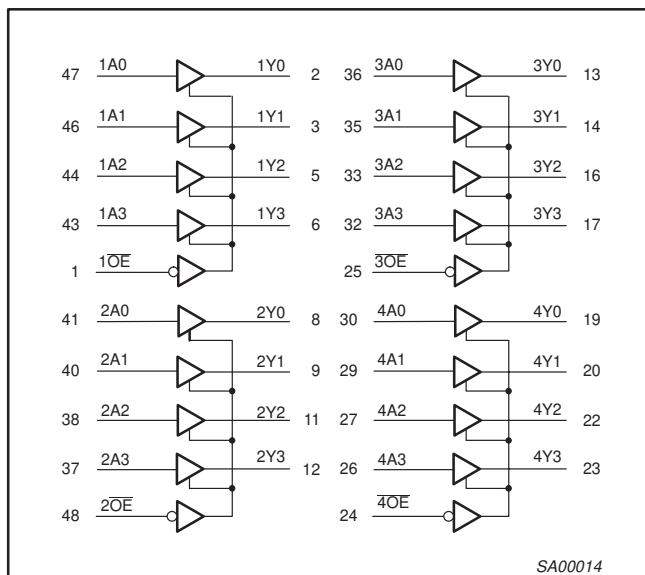
## QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS $T_{amb} = 25^{\circ}C$	TYPICAL		UNIT
			2.5V	3.3V	
$t_{PLH}$ $t_{PHL}$	Propagation delay nAx to nYx	$C_L = 50pF$	1.8 1.9	1.5 1.5	ns
$C_{IN}$	Input capacitance DIR, OE	$V_I = 0V$ or $V_{CC}$	3	3	pF
$C_{Out}$	Output capacitance	$V_{IO} = 0V$ or $V_{CC}$	9	9	pF
$I_{CCZ}$	Total supply current	Outputs disabled	40	70	$\mu A$

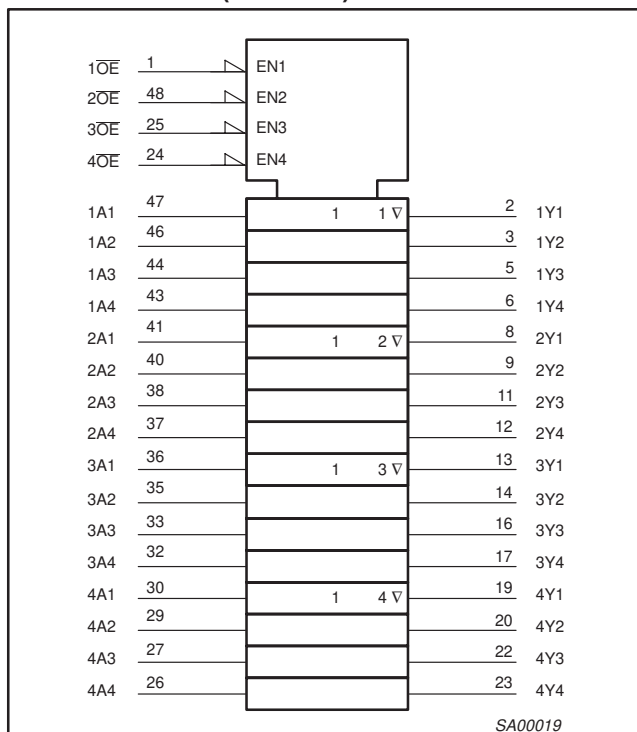
## ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	DWG NUMBER
48-Pin Plastic SSOP Type III	-40°C to +85°C	74ALVT16244 DL	AV16244 DL	SOT370-1
48-Pin Plastic TSSOP Type II	-40°C to +85°C	74ALVT16244 DGG	AV16244 DGG	SOT362-1

## LOGIC SYMBOL



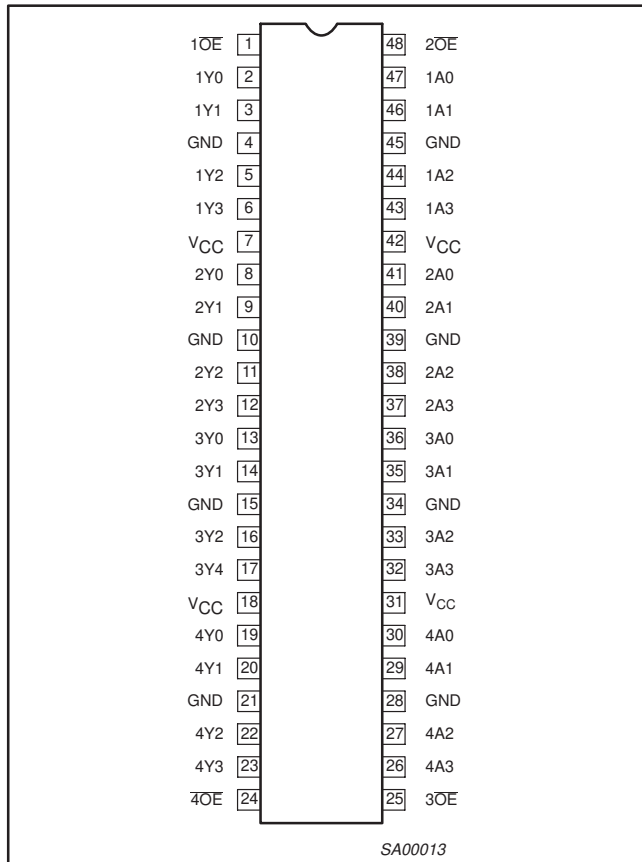
## LOGIC SYMBOL (IEEE/IEC)



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

# 74ALVT16244

## PIN CONFIGURATION



## PIN DESCRIPTION

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

## FUNCTION TABLE

INPUTS		OUTPUTS
nOE	nAx	nYx
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

## ABSOLUTE MAXIMUM RATINGS<sup>1, 2</sup>

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 <sup>3</sup>		-0.5 to +7.0	V
I <sub>OK</sub>	DC output diode current	V <sub>O</sub> < 0	-50	mA
V <sub>OUT</sub>	DC output voltage <sup>3</sup>	Output in Off or High state	-0.5 to +7.0	V
I <sub>OUT</sub>	DC output current	Output in Low state	128	mA
		Output in High state	-64	
T <sub>stg</sub>	Storage temperature range		-65 to +150	°C

### NOTES:

- 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.
- The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability. The maximum junction temperature of this integrated circuit should not exceed 150°C.
- The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.

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

74ALVT16244

## RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	2.5V RANGE LIMITS		3.3V RANGE LIMITS		UNIT
		MIN	MAX	MIN	MAX	
V <sub>CC</sub>	DC supply voltage	2.3	2.7	3.0	3.6	V
V <sub>I</sub>	Input voltage	0	5.5	0	5.5	V
V <sub>IH</sub>	High-level input voltage	1.7		2.0		V
V <sub>IL</sub>	Input voltage		0.7		0.8	V
I <sub>OH</sub>	High-level output current		-8		-32	mA
I <sub>OL</sub>	Low-level output current		8		32	mA
	Low-level output current; current duty cycle ≤ 50%; f ≥ 1 kHz		24		64	
Δt/Δv	Input transition rise or fall rate; Outputs enabled		10		10	ns/V
T <sub>amb</sub>	Operating free-air temperature range	-40	+85	-40	+85	°C

## DC ELECTRICAL CHARACTERISTICS (3.3V ± 0.3V RANGE)

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT
			Temp = -40°C to +85°C			
			MIN	TYP <sup>1</sup>	MAX	
V <sub>IK</sub>	Input clamp voltage	V <sub>CC</sub> = 3.0V; I <sub>IK</sub> = -18mA		-0.85	-1.2	V
V <sub>OH</sub>	High-level output voltage	V <sub>CC</sub> = 3.0 to 3.6V; I <sub>OH</sub> = -100μA	V <sub>CC</sub> -0.2	V <sub>CC</sub>		V
		V <sub>CC</sub> = 3.0V; I <sub>OH</sub> = -32mA	2.0	2.3		
V <sub>OL</sub>	Low-level output voltage	V <sub>CC</sub> = 3.0V; I <sub>OL</sub> = 100μA		0.07	0.2	V
		V <sub>CC</sub> = 3.0V; I <sub>OL</sub> = 16mA		0.25	0.4	
		V <sub>CC</sub> = 3.0V; I <sub>OL</sub> = 32mA		0.3	0.5	
		V <sub>CC</sub> = 3.0V; I <sub>OL</sub> = 64mA		0.4	0.55	
I <sub>I</sub>	Input leakage current	V <sub>CC</sub> = 3.6V; V <sub>I</sub> = V <sub>CC</sub> or GND	Control pins	0.1	±1	μA
		V <sub>CC</sub> = 0 or 3.6V; V <sub>I</sub> = 5.5V		0.1	10	
		V <sub>CC</sub> = 3.6V; V <sub>I</sub> = V <sub>CC</sub>	Data pins <sup>4</sup>	0.5	1	
		V <sub>CC</sub> = 3.6V; V <sub>I</sub> = 0V		0.1	-5	
I <sub>OFF</sub>	Off current	V <sub>CC</sub> = 0V; V <sub>I</sub> or V <sub>O</sub> = 0 to 4.5V		0.1	±100	μA
I <sub>HOLD</sub>	Bus Hold current Data inputs <sup>6</sup>	V <sub>CC</sub> = 3V; V <sub>I</sub> = 0.8V	75	130		μA
		V <sub>CC</sub> = 3V; V <sub>I</sub> = 2.0V	-75	-140		
		V <sub>CC</sub> = 0V to 3.6V; V <sub>CC</sub> = 3.6V	±500			
I <sub>EX</sub>	Current into an output in the High state when V <sub>O</sub> > V <sub>CC</sub>	V <sub>O</sub> = 5.5V; V <sub>CC</sub> = 3.0V		10	125	μA
I <sub>PU/PD</sub>	Power up/down 3-State output current <sup>3</sup>	V <sub>CC</sub> ≤ 1.2V; V <sub>O</sub> = 0.5V to V <sub>CC</sub> ; V <sub>I</sub> = GND or V <sub>CC</sub> OE/OE = Don't care		1	±100	μA
I <sub>OZH</sub>	3-State output High current	V <sub>CC</sub> = 3.6V; V <sub>O</sub> = 3.0V; V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>		0.5	5	μA
I <sub>OZL</sub>	3-State output Low current	V <sub>CC</sub> = 3.6V; V <sub>O</sub> = 0.5V; V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>		0.5	-5	μA
I <sub>CCH</sub>	Quiescent supply current	V <sub>CC</sub> = 3.6V; Outputs High, V <sub>I</sub> = GND or V <sub>CC</sub> , I <sub>O</sub> = 0		0.05	0.1	mA
I <sub>CCL</sub>		V <sub>CC</sub> = 3.6V; Outputs Low, V <sub>I</sub> = GND or V <sub>CC</sub> , I <sub>O</sub> = 0		3.6	5	
I <sub>CCZ</sub>		V <sub>CC</sub> = 3.6V; Outputs Disabled; V <sub>I</sub> = GND or V <sub>CC</sub> , I <sub>O</sub> = 0 <sup>5</sup>		0.06	0.1	
ΔI <sub>CC</sub>	Additional supply current per input pin <sup>2</sup>	V <sub>CC</sub> = 3V to 3.6V; One input at V <sub>CC</sub> -0.6V, Other inputs at V <sub>CC</sub> or GND		0.04	0.4	mA

## NOTES:

- All typical values are at V<sub>CC</sub> = 3.3V and T<sub>amb</sub> = 25°C.
- This is the increase in supply current for each input at the specified voltage level other than V<sub>CC</sub> or GND.
- This parameter is valid for any V<sub>CC</sub> between 0V and 1.2V with a transition time of up to 10msec. From V<sub>CC</sub> = 1.2V to V<sub>CC</sub> = 3.3V ± 0.3V a transition time of 100μsec is permitted. This parameter is valid for T<sub>amb</sub> = 25°C only.
- Unused pins at V<sub>CC</sub> or GND.
- I<sub>CCZ</sub> is measured with outputs pulled up to V<sub>CC</sub> or pulled down to ground.
- This is the bus hold overdrive current required to force the input to the opposite logic state.

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

74ALVT16244

**AC CHARACTERISTICS (3.3V ± 0.3V RANGE)**GND = 0V;  $t_R = t_F = 2.5\text{ns}$ ;  $C_L = 50\text{pF}$ ;  $R_L = 500\Omega$ ;  $T_{\text{amb}} = -40^\circ\text{C}$  to  $+85^\circ\text{C}$ .

SYMBOL	PARAMETER	WAVEFORM	LIMITS			UNIT
			$V_{CC} = 3.3V \pm 0.3V$			
			MIN	TYP <sup>1</sup>	MAX	
$t_{PLH}$ $t_{PHL}$	Propagation delay nAx to nYx	1	0.8 0.8	1.5 1.5	2.4 2.5	ns
$t_{PZH}$ $t_{PZL}$	Output enable time to High and Low level	2	1.0 0.5	2.3 1.8	3.8 2.9	ns
$t_{PHZ}$ $t_{PLZ}$	Output disable time from High and Low Level	2	1.5 1.5	2.7 2.3	4.2 3.6	ns

**NOTE:**1. All typical values are at  $V_{CC} = 3.3V$  and  $T_{\text{amb}} = 25^\circ\text{C}$ .**DC ELECTRICAL CHARACTERISTICS (2.5V ± 0.2V RANGE)**

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT
			Temp = $-40^\circ\text{C}$ to $+85^\circ\text{C}$			
			MIN	TYP <sup>1</sup>	MAX	
$V_{IK}$	Input clamp voltage	$V_{CC} = 2.3V$ ; $I_{IK} = -18\text{mA}$		-0.85	-1.2	V
$V_{OH}$	High-level output voltage	$V_{CC} = 2.3$ to $2.7V$ ; $I_{OH} = -100\mu\text{A}$ $V_{CC} = 2.3V$ ; $I_{OH} = -8\text{mA}$	$V_{CC}-0.2$ 1.8	$V_{CC}$ 2.5		V
$V_{OL}$	Low-level output voltage	$V_{CC} = 2.3V$ ; $I_{OL} = 100\mu\text{A}$ $V_{CC} = 2.3V$ ; $I_{OL} = 24\text{mA}$		0.07 0.3	0.2 0.5	
$I_I$	Input leakage current	$V_{CC} = 2.7V$ ; $V_I = V_{CC}$ or GND $V_{CC} = 0$ or $2.7V$ ; $V_I = 5.5V$ $V_{CC} = 2.7V$ ; $V_I = V_{CC}$ $V_{CC} = 2.7V$ ; $V_I = 0$	Control pins  Data pins <sup>4</sup>	0.1 0.1 0.1 0.1	$\pm 1$ 10 1 -5	$\mu\text{A}$
$I_{OFF}$	Off current	$V_{CC} = 0V$ ; $V_I$ or $V_O = 0$ to $4.5V$		0.1	$\pm 100$	$\mu\text{A}$
$I_{HOLD}$	Bus Hold current Data inputs <sup>6</sup>	$V_{CC} = 2.3V$ ; $V_I = 0.7V$ $V_{CC} = 2.3V$ ; $V_I = 1.7V$		115 -10		$\mu\text{A}$
$I_{EX}$	Current into an output in the High state when $V_O > V_{CC}$	$V_O = 5.5V$ ; $V_{CC} = 2.3V$		10	125	$\mu\text{A}$
$I_{PU/PD}$	Power up/down 3-State output current <sup>3</sup>	$V_{CC} \leq 1.2V$ ; $V_O = 0.5V$ to $V_{CC}$ ; $V_I = \text{GND}$ or $V_{CC}$ ; OE/OE = Don't care		1	$\pm 100$	$\mu\text{A}$
$I_{OZH}$	3-State output High current	$V_{CC} = 2.7V$ ; $V_O = 2.3V$ ; $V_I = V_{IL}$ or $V_{IH}$		0.5	5	$\mu\text{A}$
$I_{OZL}$	3-State output Low current	$V_{CC} = 2.7V$ ; $V_O = 0.5V$ ; $V_I = V_{IL}$ or $V_{IH}$		0.5	-5	$\mu\text{A}$
$I_{CCH}$	Quiescent supply current	$V_{CC} = 2.7V$ ; Outputs High, $V_I = \text{GND}$ or $V_{CC}$ , $I_O = 0$		0.04	0.1	mA
$I_{CCL}$		$V_{CC} = 2.7V$ ; Outputs Low, $V_I = \text{GND}$ or $V_{CC}$ , $I_O = 0$		2.5	4.5	
$I_{CCZ}$		$V_{CC} = 2.7V$ ; Outputs Disabled; $V_I = \text{GND}$ or $V_{CC}$ , $I_O = 0^5$		0.04	0.1	
$\Delta I_{CC}$	Additional supply current per input pin <sup>2</sup>	$V_{CC} = 2.3V$ to $2.7V$ ; One input at $V_{CC}-0.6V$ , Other inputs at $V_{CC}$ or GND		0.04	0.4	mA

**NOTES:**

- All typical values are at  $V_{CC} = 2.5V$  and  $T_{\text{amb}} = 25^\circ\text{C}$ .
- This is the increase in supply current for each input at the specified voltage level other than  $V_{CC}$  or GND
- This parameter is valid for any  $V_{CC}$  between 0V and 1.2V with a transition time of up to 10msec. From  $V_{CC} = 1.2V$  to  $V_{CC} = 2.5V \pm 0.2V$  a transition time of 100 $\mu\text{sec}$  is permitted. This parameter is valid for  $T_{\text{amb}} = 25^\circ\text{C}$  only.
- Unused pins at  $V_{CC}$  or GND.
- $I_{CCZ}$  is measured with outputs pulled up to  $V_{CC}$  or pulled down to ground.
- Not guaranteed.

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

74ALVT16244

## AC CHARACTERISTICS (2.5V ± 0.2V RANGE)

GND = 0V;  $t_R = t_F = 2.5\text{ns}$ ;  $C_L = 50\text{pF}$ ;  $R_L = 500\Omega$ ;  $T_{\text{amb}} = -40^\circ\text{C}$  to  $+85^\circ\text{C}$ .

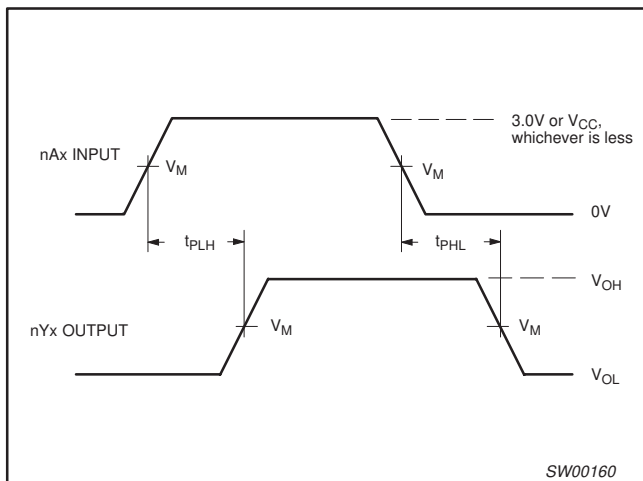
SYMBOL	PARAMETER	WAVEFORM	LIMITS			UNIT
			$V_{CC} = 2.5V \pm 0.2V$			
			MIN	TYP <sup>1</sup>	MAX	
$t_{PLH}$ $t_{PHL}$	Propagation delay nAx to nYx	1	1.0 1.0	1.8 1.9	3.0 3.5	ns
$t_{PZH}$ $t_{PZL}$	Output enable time to High and Low level	2	2.0 1.5	3.1 2.5	5.9 4.7	ns
$t_{PHZ}$ $t_{PLZ}$	Output disable time from High and Low Level	2	1.5 1.0	2.7 2.0	4.4 3.4	ns

**NOTE:**

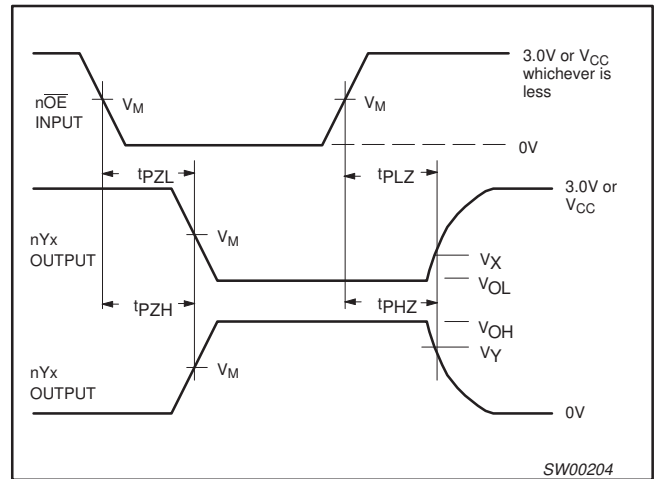
1. All typical values are at  $V_{CC} = 2.5V$  and  $T_{\text{amb}} = 25^\circ\text{C}$ .

## AC WAVEFORMS

$V_M = 1.5V$  at  $V_{CC} \geq 3.0V$ ;  $V_M = V_{CC}/2$  at  $V_{CC} \leq 2.7V$   
 $V_X = V_{OL} + 0.3V$  at  $V_{CC} \geq 3.0V$ ;  $V_X = V_{OL} + 0.15V$  at  $V_{CC} \leq 2.7V$   
 $V_Y = V_{OH} - 0.3V$  at  $V_{CC} \geq 3.0V$ ;  $V_Y = V_{OH} - 0.15V$  at  $V_{CC} \leq 2.7V$



Waveform 1. Input (nAx) to Output (nYx) Propagation Delays



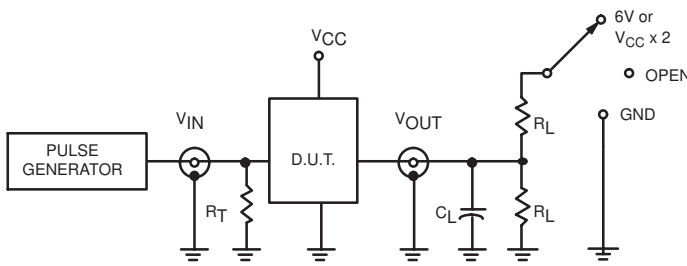
Waveform 2. 3-State Output Enable and Disable Times



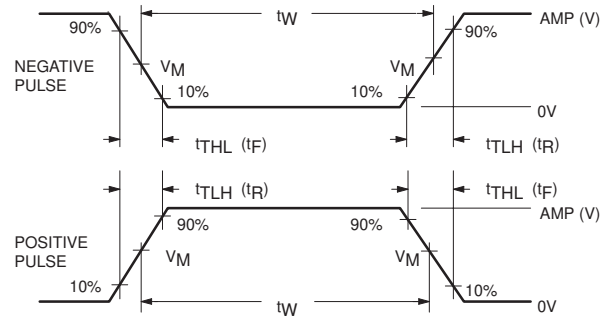
# 2.5V/3.3V 16-bit buffer/driver (3-State)

# 74ALVT16244

## TEST CIRCUIT AND WAVEFORMS



Test Circuit for 3-State Outputs



$V_M = 1.5V$  or  $V_{CC} / 2$ , whichever is less  
Input Pulse Definition

### SWITCH POSITION

TEST	SWITCH
$t_{PHZ}/t_{PZH}$	GND
$t_{PLZ}/t_{PZL}$	6V or $V_{CC} \times 2$
$t_{PLH}/t_{PHL}$	open

### DEFINITIONS

- $R_L$  = Load resistor; see AC CHARACTERISTICS for value.
- $C_L$  = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.
- $R_T$  = Termination resistance should be equal to  $Z_{OUT}$  of pulse generators.

FAMILY	INPUT PULSE REQUIREMENTS				
	Amplitude	Rep. Rate	$t_w$	$t_R$	$t_F$
74ALVT16	3.0V or $V_{CC}$ whichever is less	$\leq 10\text{MHz}$	500ns	$\leq 2.5\text{ns}$	$\leq 2.5\text{ns}$

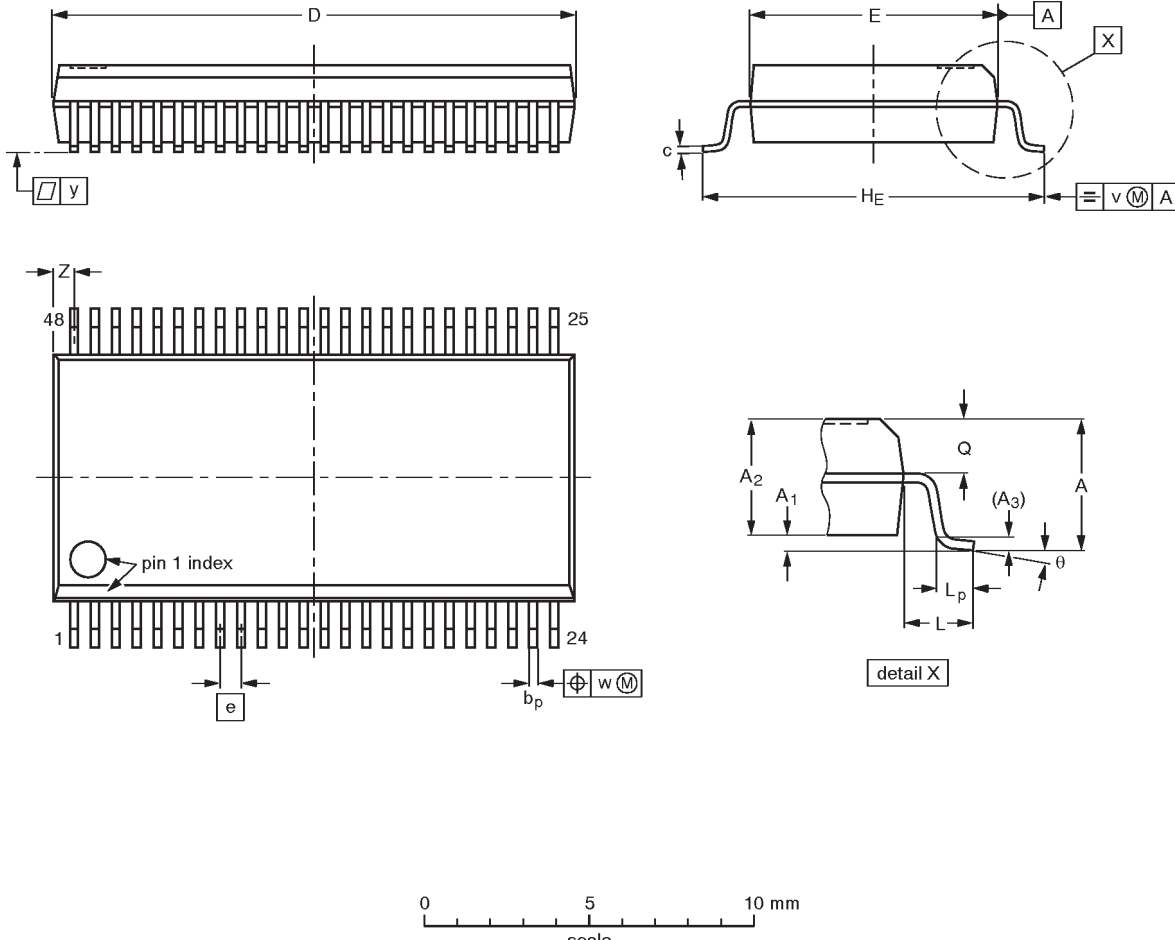
SW00162

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

74ALVT16244

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	0.4 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.

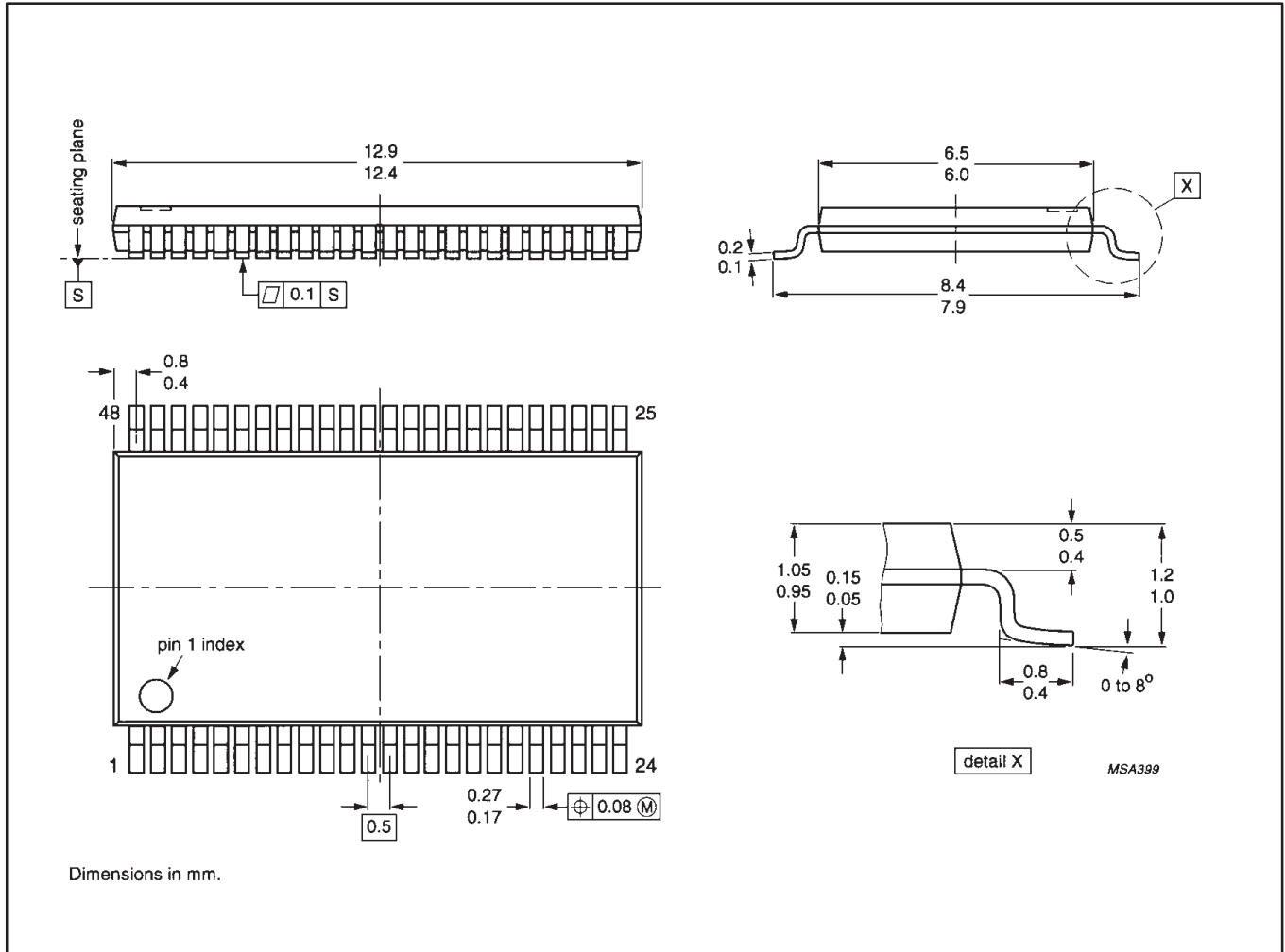
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT370-1		MO-118AA				93-11-02- 95-02-04

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

# 74ALVT16244

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

SOT362-1



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

74ALVT16244

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Data sheet status	Product status	Definition [1]
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