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# DATA SHEET

**74LVT16240A**

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

Product data  
Supersedes data of 1998 Feb 19

2003 Feb 21

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

### 74LVT16240A

#### FEATURES

- 16-bit bus interface
- 3-State buffers
- Output capability: +64 mA/-32 mA
- TTL input and output switching levels
- Input and output interface capability to systems at 5 V 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 5 V bus
- Latch-up protection exceeds 500 mA per JEDEC Std 17
- ESD protection exceeds 2000 V per MIL STD 883 Method 3015 and 200 V per Machine Model

#### DESCRIPTION

The 74LVT16240A is a high-performance BiCMOS product designed for  $V_{CC}$  operation at 3.3 V.

This device is an inverting 16-bit buffer that is ideal for driving bus lines. The device features four Output Enables (1OE, 2OE, 3OE, 4OE), each controlling four of the 3-State outputs.

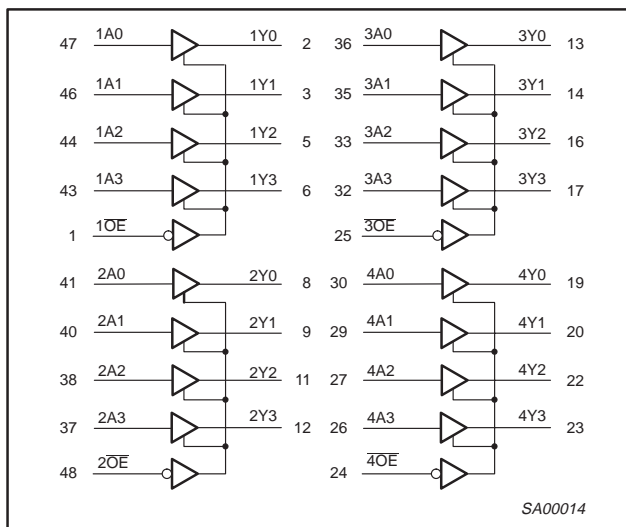
#### QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS $T_{amb} = 25\text{ }^{\circ}\text{C}$	TYPICAL	UNIT
$t_{PLH}$ $t_{PHL}$	Propagation delay nAx to nYx	$C_L = 50\text{ pF}$ ; $V_{CC} = 3.3\text{ V}$	1.9	ns
$C_{IN}$	Input capacitance nOE	$V_I = 0\text{ V}$ or 3.0 V	3	pF
$C_{OUT}$	Output capacitance	Outputs disabled; $V_O = 0\text{ V}$ or 3.0 V	9	pF
$I_{CCZ}$	Total supply current	Outputs disabled; $V_{CC} = 3.6\text{ V}$	70	$\mu\text{A}$

#### ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	PART NUMBER	DWG NUMBER
48-Pin Plastic SSOP Type III	-40 °C to +85 °C	74LVT16240ADL	SOT370-1
48-Pin Plastic TSSOP Type II	-40 °C to +85 °C	74LVT16240ADGG	SOT362-1

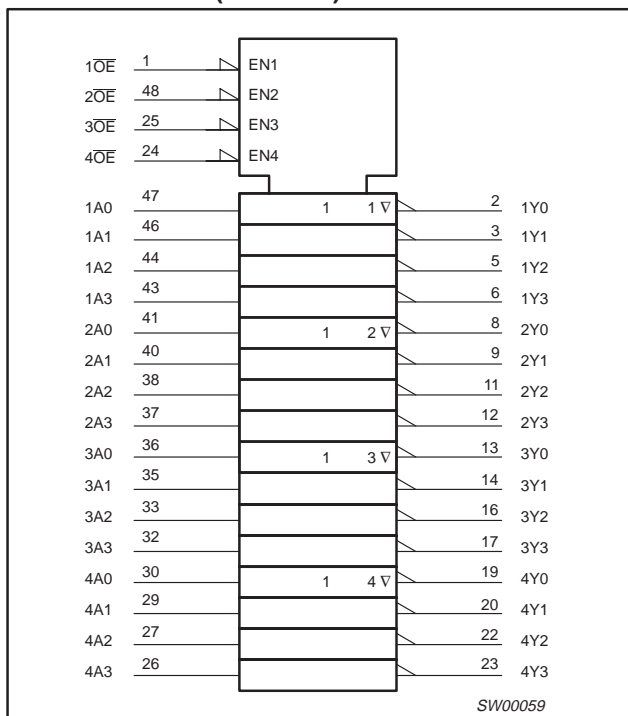
#### LOGIC SYMBOL



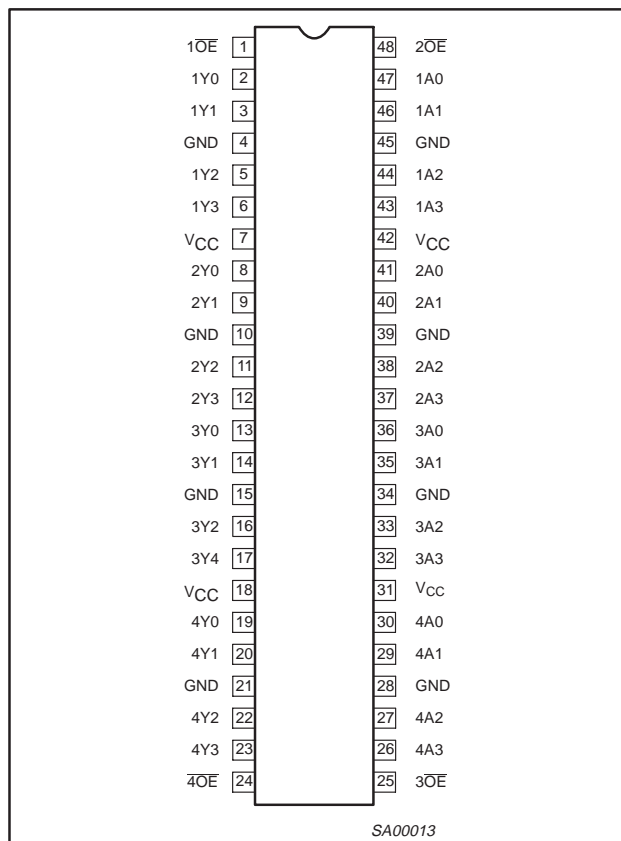
### 3.3 V 16-bit inverting buffer/driver (3-State)

### 74LVT16240A

#### LOGIC SYMBOL (IEEE/IEC)



#### PIN CONFIGURATION



#### FUNCTION TABLE

Inputs		Outputs
nOE	nAx	nYx
L	L	H
L	H	L
H	X	Z

H = HIGH voltage level  
 L = LOW voltage level  
 X = Don't care  
 Z = High Impedance "off" state

#### 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 (0 V)
7, 18, 31, 42	V <sub>CC</sub>	Positive supply voltage

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

74LVT16240A

#### 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 V	-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 V	-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.

#### RECOMMENDED OPERATING CONDITIONS

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

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

74LVT16240A

#### DC ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT	
			T <sub>amb</sub> = -40 °C to +85 °C				
			MIN	TYP <sup>1</sup>	MAX		
V <sub>IK</sub>	Input clamp voltage	V <sub>CC</sub> = 2.7 V; I <sub>IK</sub> = -18 mA		-0.85	1.2	V	
V <sub>OH</sub>	HIGH-level output voltage	V <sub>CC</sub> = 2.7 V to 3.6 V; I <sub>OH</sub> = -100 μA	V <sub>CC</sub> -0.2	V <sub>CC</sub>		V	
		V <sub>CC</sub> = 2.7 V; I <sub>OH</sub> = -8 mA	2.4	2.5			
		V <sub>CC</sub> = 3.0 V; I <sub>OH</sub> = -32 mA	2.0	2.3			
V <sub>OL</sub>	LOW-level output voltage	V <sub>CC</sub> = 2.7 V; I <sub>OL</sub> = 100 μA		0.07	0.2	V	
		V <sub>CC</sub> = 2.7 V; I <sub>OL</sub> = 24 mA		0.03	0.5		
		V <sub>CC</sub> = 3.0 V; I <sub>OL</sub> = 16 mA		0.25	0.4		
		V <sub>CC</sub> = 3.0 V; I <sub>OL</sub> = 32 mA		0.30	0.5		
		V <sub>CC</sub> = 3.0 V; I <sub>OL</sub> = 64 mA		0.40	0.55		
I <sub>I</sub>	Input leakage current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND	Control pins		0.1	±1.0	μA
		V <sub>CC</sub> = 0 V or 3.6 V; V <sub>I</sub> = 5.5 V			0.4	10	
		V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub>	Data pins <sup>4</sup>		0.1	1	
		V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = 0 V			-0.4	-5	
I <sub>OFF</sub>	Output off current	V <sub>CC</sub> = 0 V; V <sub>I</sub> or V <sub>O</sub> = 0 V to 4.5 V		0.1	±100	μA	
I <sub>HOLD</sub>	Bus Hold current A inputs <sup>6</sup>	V <sub>CC</sub> = 3 V; V <sub>I</sub> = 0.8 V	75	135		μA	
		V <sub>CC</sub> = 3 V; V <sub>I</sub> = 2.0 V	-75	-135			
		V <sub>CC</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 3.6 V	±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> = 5.5 V; V <sub>CC</sub> = 3.0 V		50	125	μA	
I <sub>PU/PD</sub>	Power-up/-down 3-State output current <sup>3</sup>	V <sub>CC</sub> ≤ 1.2 V; V <sub>O</sub> = 0.5 V 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> = 3.6 V; V <sub>O</sub> = 3.0 V; 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> = 3.6 V; V <sub>O</sub> = 0.5 V; V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>		0.5	-5		
I <sub>CCH</sub>	Quiescent supply current	V <sub>CC</sub> = 3.6 V; Outputs High, V <sub>I</sub> = GND or V <sub>CC</sub> , I <sub>O</sub> = 0		0.07	0.12	mA	
I <sub>CCL</sub>		V <sub>CC</sub> = 3.6 V; Outputs Low, V <sub>I</sub> = GND or V <sub>CC</sub> , I <sub>O</sub> = 0		4.0	6.0		
I <sub>CCZ</sub>		V <sub>CC</sub> = 3.6 V; Outputs Disabled; V <sub>I</sub> = GND or V <sub>CC</sub> , I <sub>O</sub> = 0 <sup>5</sup>		0.07	0.12		
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		0.1	0.20	mA	

#### NOTES:

- All typical values are at V<sub>CC</sub> = 3.3 V 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 0 V and 1.2 V with a transition time of up to 10 msec. From V<sub>CC</sub> = 1.2 V to V<sub>CC</sub> = 3.3 V ± 0.3 V a transition time of 100 μsec 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 to V<sub>CC</sub> or GND.
- This is the bus hold overdrive current required to force the input to the opposite logic state.

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

74LVT16240A

**AC CHARACTERISTICS**

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

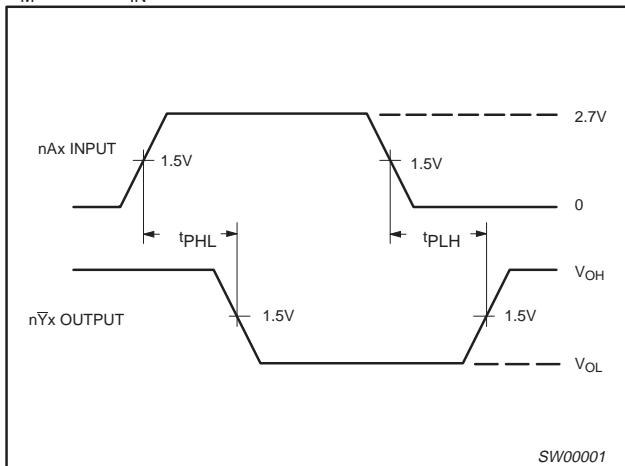
SYMBOL	PARAMETER	WAVEFORM	LIMITS				UNIT
			$V_{CC} = 3.3 V \pm 0.3 V$			$V_{CC} = 2.7 V$	
			MIN	TYP <sup>1</sup>	MAX	MAX	
$t_{PLH}$ $t_{PHL}$	Propagation delay nAx to nYx	1	0.5 0.5	1.8 2.0	3.2 3.2	4.0 4.0	ns
$t_{PZH}$ $t_{PZL}$	Output enable time to HIGH and LOW level	2	1.0 1.0	2.3 2.1	4.0 4.4	5.0 4.8	ns
$t_{PHZ}$ $t_{PLZ}$	Output disable time from HIGH and LOW Level	2	1.0 1.0	3.2 3.0	4.5 4.4	5.0 4.8	ns

**NOTE:**

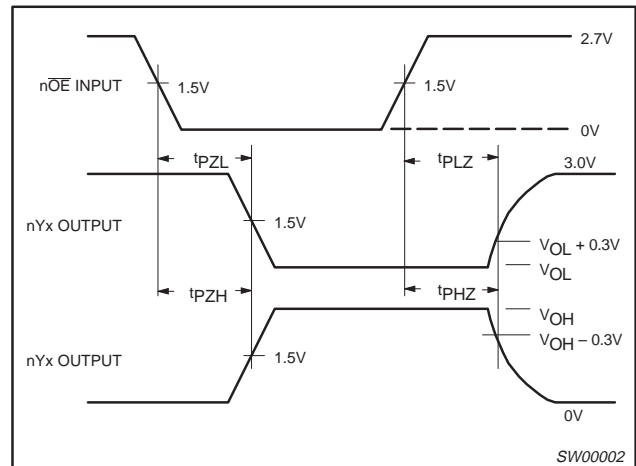
1. All typical values are at  $V_{CC} = 3.3 V$  and  $T_{amb} = 25$  °C.

**AC WAVEFORMS**

$V_M = 1.5 V$ ,  $V_{IN} = GND$  to  $2.7 V$



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



Waveform 2. 3-State Output Enable and Disable Times

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

74LVT16240A

TEST CIRCUIT AND WAVEFORMS

The test circuit diagram shows a Pulse Generator connected to the input of a D.U.T. (Device Under Test) through a termination resistor  $R_T$ . The output of the D.U.T. is connected to a load resistor  $R_L$  and a load capacitor  $C_L$ . A switch selects between a 6V source, an OPEN state, and GND. The input pulse definition shows a negative pulse with amplitude  $V_M$  and a positive pulse with amplitude  $V_M$ . The pulse width is  $t_W$ . The rise and fall times are  $t_{TLH}$  ( $t_R$ ) and  $t_{THL}$  ( $t_F$ ) respectively. The input pulse definition is for  $V_M = 1.5 V$ .

**Test Circuit for 3-State Outputs**

**SWITCH POSITION**

TEST	SWITCH
$t_{PHZ}/t_{PZH}$	GND
$t_{PLZ}/t_{PZL}$	6 V
$t_{PLH}/t_{PHL}$	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.

**INPUT PULSE REQUIREMENTS**

FAMILY	INPUT PULSE REQUIREMENTS				
	Amplitude	Rep. Rate	$t_W$	$t_R$	$t_F$
74LVT16	2.7 V	$\leq 10$ MHz	500 ns	$\leq 2.5$ ns	$\leq 2.5$ ns

SW00003

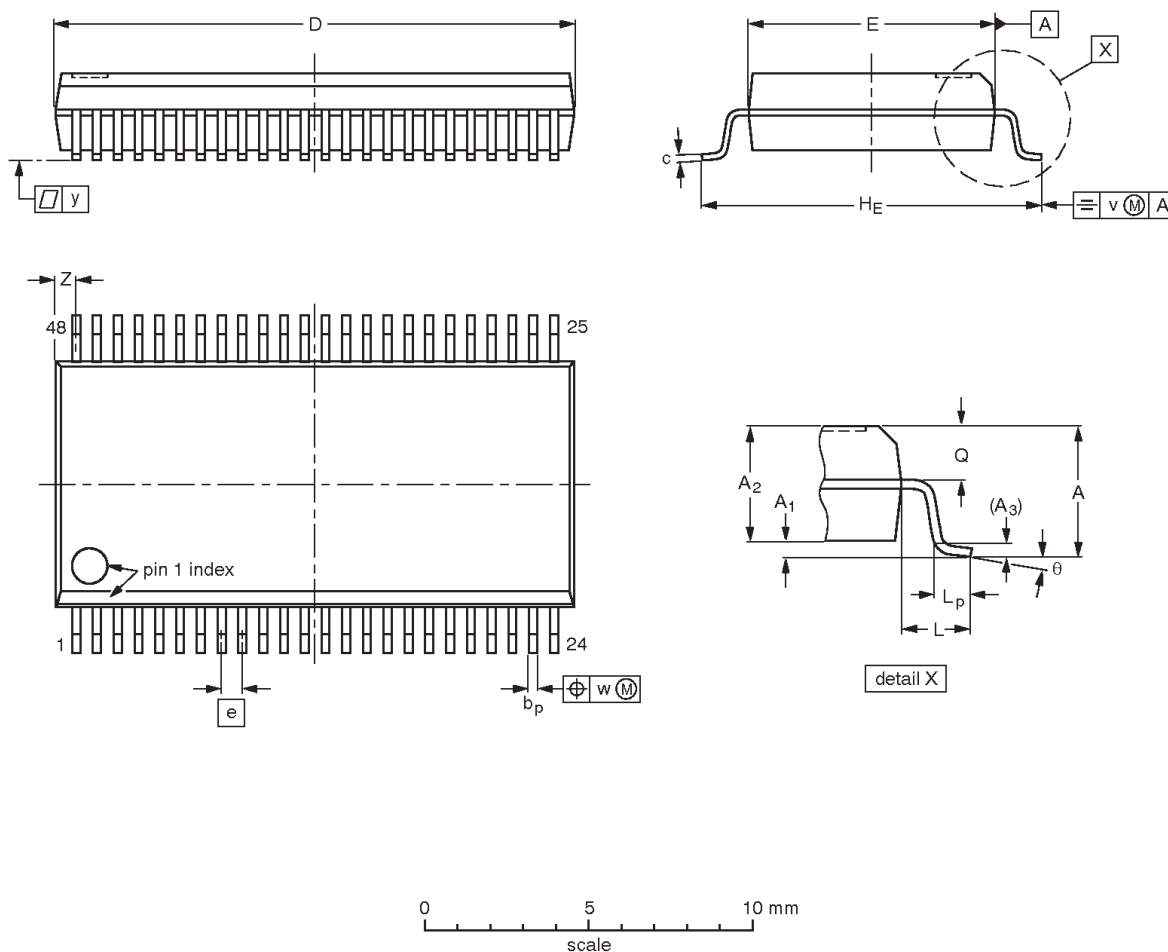


3.3 V 16-bit inverting buffer/driver (3-State)

74LVT16240A

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.

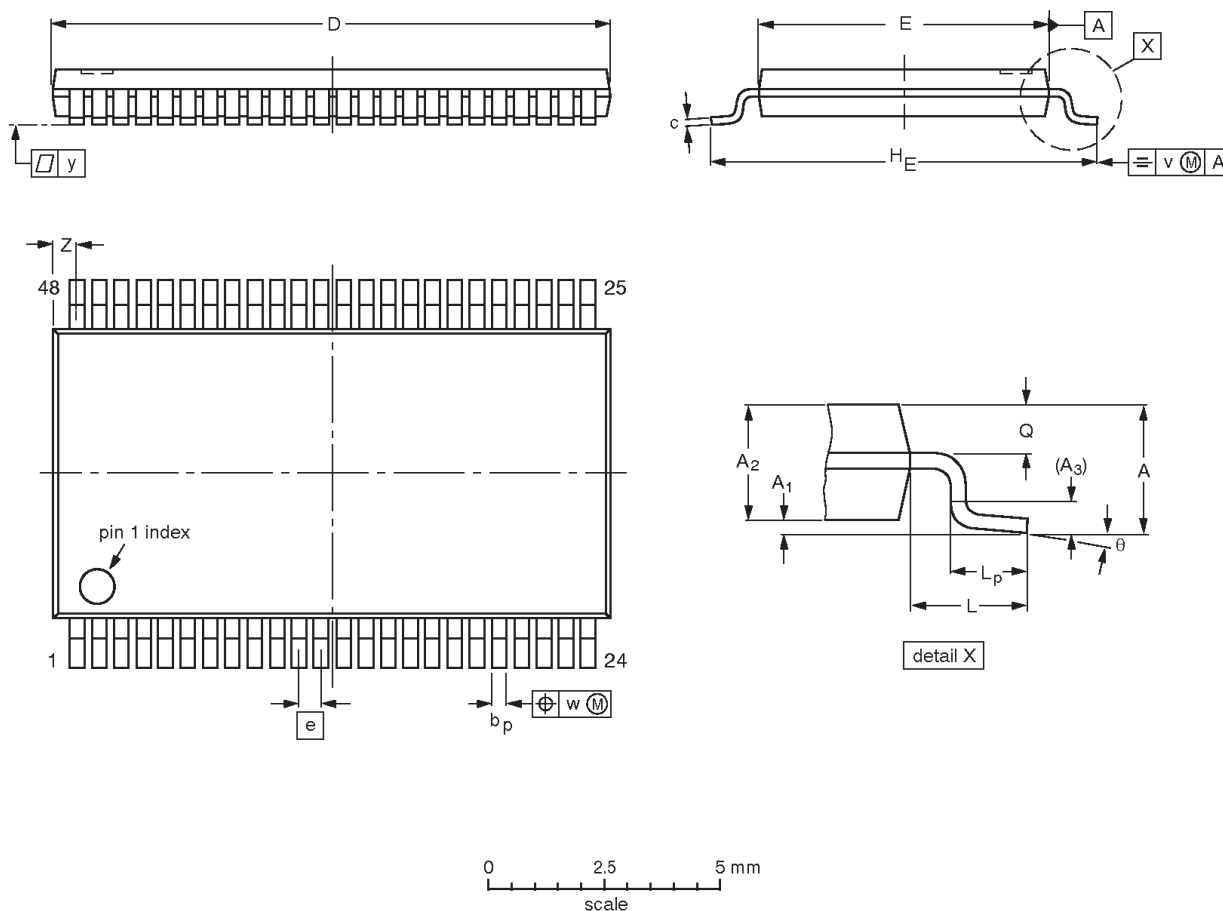
OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ		
SOT370-1		MO-118			95-02-04 99-12-27

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

74LVT16240A

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

SOT362-1



**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>(2)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z	θ
mm	1.2	0.15 0.05	1.05 0.85	0.25	0.28 0.17	0.2 0.1	12.6 12.4	6.2 6.0	0.5	8.3 7.9	1	0.8 0.4	0.50 0.35	0.25	0.08	0.1	0.8 0.4	8° 0°

**Notes**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT362-1		MO-153				95-02-10 99-12-27

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

74LVT16240A

#### REVISION HISTORY

Rev	Date	Description
_3	20030221	<b>Product data (9397 750 11152); ECN 853-1776 29438); supersedes product specification of 1998 Feb 19 (9397 750 03547).</b> Modifications: <ul style="list-style-type: none"> <li>• Ordering information table on page 2 corrected: remove 'North America' column.</li> <li>• "Logic symbol (IEEE/IEC)" on page 3 modified to correct pin names.</li> </ul>
_2	19980219	<b>Product specification (9397 750 03547); ECN 853-1776 18990; supersedes data of 1994 Dec 15.</b>

#### Data sheet status

Level	Data sheet status [1]	Product status [2] [3]	Definitions
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
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[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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**Short-form specification** — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

**Limiting values definition** — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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9397 750 11152

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