

# 74ALVT16244

16-bit buffer/line driver; 3-state

Rev. 5 — 2 February 2018

Product data sheet

## 1 General 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.

## 2 Features and benefits

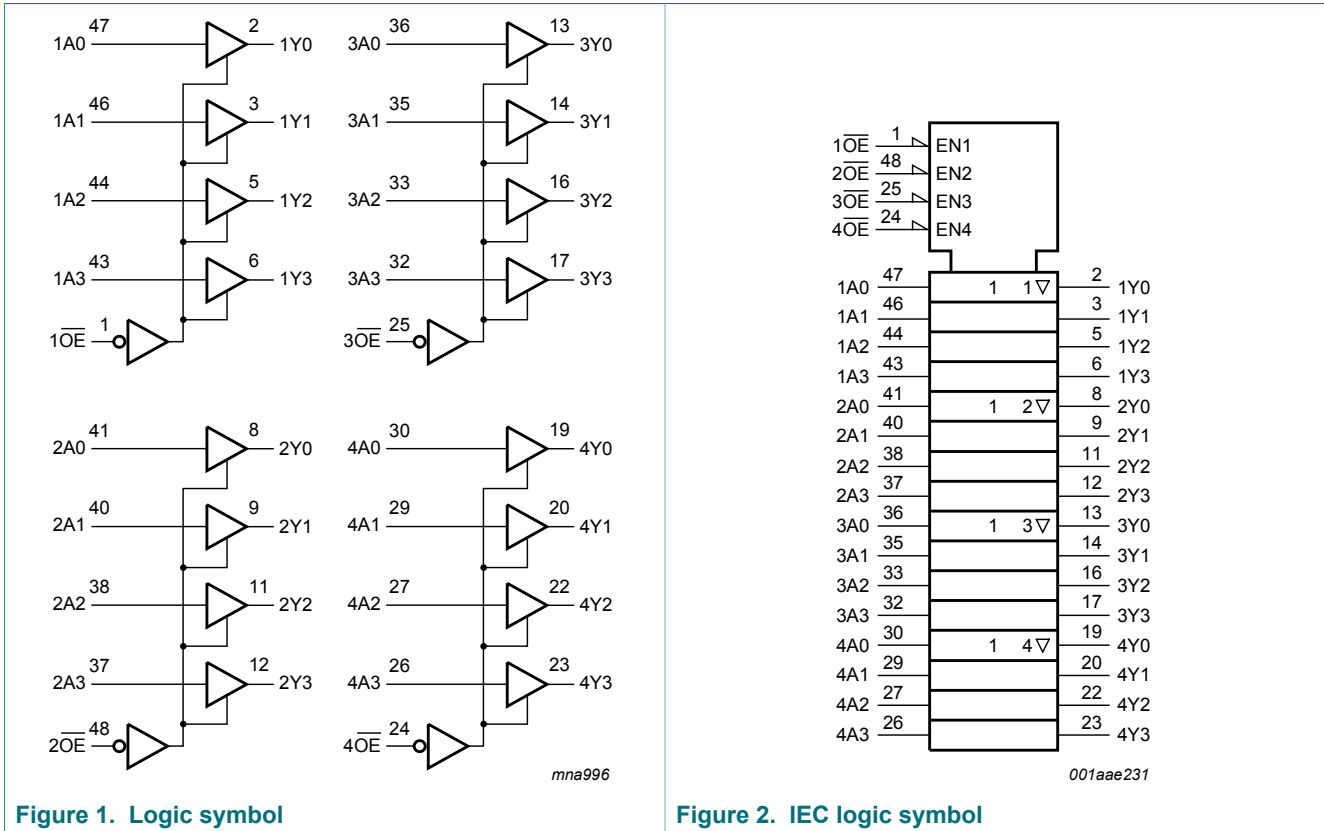
- 16-bit bus interface
- 3-State buffers
- 5V I/O compatible
- Output capability: +64 mA/-32 mA
- TTL input and output switching levels
- Input and output interface capability to systems at 5 V supply
- Bus-hold data inputs eliminate the need for external pull-up resistors to hold unused inputs
- Live insertion/extraction permitted
- Power-up 3-State
- No bus current loading when output is tied to 5 V bus
- Latch-up protection:
  - JESD17: exceeds 500 mA
- ESD protection:
  - MIL STD 883 method 3015: exceeds 2000 V
  - MM exceeds 200 V

## 3 Ordering information

Table 1. Ordering information

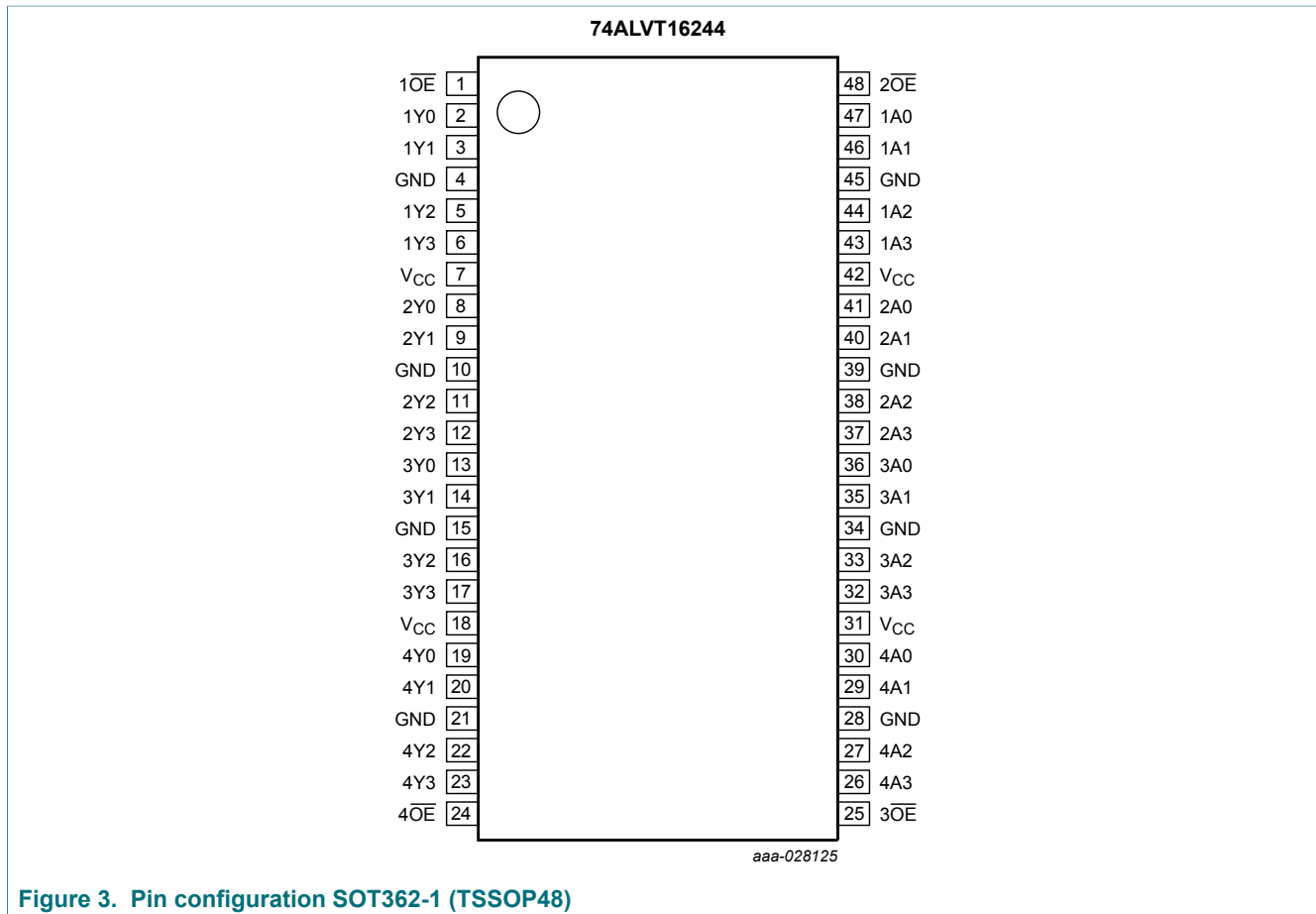
Type number	Package			
	Temperature range	Name	Description	Version
74ALVT16244DGG	-40 °C to +85 °C	TSSOP48	plastic thin shrink small outline package; 48 leads; body width 6.1 mm	SOT362-1

4 Functional diagram



## 5 Pinning information

### 5.1 Pinning



**Figure 3. Pin configuration SOT362-1 (TSSOP48)**

## 5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
1 $\overline{O}E$ , 2 $\overline{O}E$ , 3 $\overline{O}E$ , 4 $\overline{O}E$	1, 48, 25, 24	output enable inputs (active LOW)
1A0, 1A1, 1A2, 1A3	47, 46, 44, 43	data inputs
2A0, 2A1, 2A2, 2A3	41, 40, 38, 37	data inputs
3A0, 3A1, 3A2, 3A3	36, 35, 33, 32	data inputs
4A0, 4A1, 4A2, 4A3	30, 29, 27, 26	data inputs
1Y0, 1Y1, 1Y2, 1Y3	2, 3, 5, 6	data outputs
2Y0, 2Y1, 2Y2, 2Y3	8, 9, 11, 12	data outputs
3Y0, 3Y1, 3Y2, 3Y3	13, 14, 16, 17	data outputs
4Y0, 4Y1, 4Y2, 4Y3	19, 20, 22, 23	data outputs
GND	4, 10, 15, 21, 28, 34, 39, 45	ground (0 V)
V <sub>CC</sub>	7, 18, 31, 42	supply voltage

## 6 Functional description

Table 3. Function table

*H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high-impedance OFF-state.*

Input		Output
n $\overline{O}E$	nAn	nYn
L	L	L
L	H	H
H	X	Z

## 7 Limiting values

**Table 4. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC}$	supply voltage		-0.5	+4.6	V
$V_I$	input voltage		[1] -0.5	+7.0	V
$V_O$	output voltage	output in OFF-state or HIGH-state	[1] -0.5	+7.0	V
$I_{IK}$	input clamping current	$V_I < 0$ V	-50	-	mA
$I_{OK}$	output clamping current	$V_O < 0$ V	-50	-	mA
$I_O$	output current	output in LOW-state	-	128	mA
		output in HIGH-state	-64	-	mA
$T_{stg}$	storage temperature		-65	+150	°C
$T_j$	junction temperature		[2] -	150	°C

[1] The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.

[2] The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability.

## 8 Recommended operating conditions

**Table 5. Recommended operating conditions**

Symbol	Parameter	Conditions	$V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$		$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$		Unit
			Min	Max	Min	Max	
$V_{CC}$	supply voltage		2.3	2.7	3.0	3.6	V
$V_I$	input voltage		0	5.5	0	5.5	V
$I_{OH}$	HIGH-level output current		-	-8	-	-32	mA
$I_{OL}$	LOW-level output current	none	-	8	-	32	mA
		current duty cycle $\leq 50$ %; $f_i \geq 1$ kHz	-	24	-	64	mA
$\Delta t/\Delta V$	input transition rise and fall rate	outputs enabled	-	10	-	10	ns/V
$T_{amb}$	ambient temperature	free-air	-40	+85	-40	+85	°C

## 9 Static characteristics

**Table 6. Static characteristics**

At recommended operating conditions;  $T_{amb} = -40$  °C to +85 °C ; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
<b><math>V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}</math></b>						
$V_{IK}$	input clamping voltage	$V_{CC} = 2.3 \text{ V}$ ; $I_{IK} = -18 \text{ mA}$	-	-0.85	-1.2	V
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$	1.7	-	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$	-	-	0.7	V

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
V <sub>OH</sub>	HIGH-level output voltage	V <sub>CC</sub> = 2.5 V ± 0.2 V; I <sub>O</sub> = -100 μA	V <sub>CC</sub> - 0.2	V <sub>CC</sub>	-	V
		V <sub>CC</sub> = 2.3 V; I <sub>O</sub> = -8 mA	1.8	2.5	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>CC</sub> = 2.3 V; I <sub>O</sub> = 100 μA	-	0.07	0.2	V
		V <sub>CC</sub> = 2.3 V; I <sub>O</sub> = 24 mA	-	0.3	0.5	V
I <sub>I</sub>	input leakage current	all input pins <sup>[2]</sup>				
		V <sub>CC</sub> = 0 V or 2.7 V; V <sub>I</sub> = 5.5 V	-	0.1	10	μA
		control pins				
		V <sub>CC</sub> = 2.7 V; V <sub>I</sub> = V <sub>CC</sub> or GND	-	0.1	±1	μA
		data pins; <sup>[2]</sup>				
		V <sub>CC</sub> = 2.7 V; V <sub>I</sub> = V <sub>CC</sub>	-	0.1	1	μA
		V <sub>CC</sub> = 2.7 V; V <sub>I</sub> = 0 V	-	0.1	-5	μA
I <sub>OFF</sub>	power-off leakage 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>BHL</sub>	bus hold LOW current	data inputs; V <sub>CC</sub> = 2.3 V; V <sub>I</sub> = 0.7 V <sup>[3]</sup>	-	115	-	μA
I <sub>BHH</sub>	bus hold HIGH current	data inputs; V <sub>CC</sub> = 2.3 V; V <sub>I</sub> = 1.7 V <sup>[3]</sup>	-	-10	-	μA
I <sub>EX</sub>	external current	output in HIGH-state when V <sub>O</sub> > V <sub>CC</sub> ; V <sub>O</sub> = 5.5 V; V <sub>CC</sub> = 2.3 V	-	10	125	μA
I <sub>O(pu/pd)</sub>	power-up/power-down output current	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> ; n $\overline{OE}$ = don't care <sup>[4]</sup>	-	1	±100	μA
I <sub>OZ</sub>	OFF-state output current	V <sub>CC</sub> = 2.7 V; V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>				
		output HIGH: V <sub>O</sub> = 2.3V	-	0.5	5	μA
		output LOW: V <sub>O</sub> = 0.5 V	-	0.5	-5	μA
I <sub>CC</sub>	supply current	V <sub>CC</sub> = 2.7 V; V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A				
		outputs HIGH	-	0.04	0.1	mA
		outputs LOW	-	2.5	4.5	mA
		outputs disabled <sup>[5]</sup>	-	0.04	0.1	mA
ΔI <sub>CC</sub>	additional supply current	per input pin; V <sub>CC</sub> = 2.3 V to 2.7 V; one input at V <sub>CC</sub> - 0.6 V; other inputs at V <sub>CC</sub> or GND <sup>[6]</sup>	-	0.04	0.4	mA
C <sub>I</sub>	input capacitance	n $\overline{OE}$ ; V <sub>I</sub> = 0 V or V <sub>CC</sub>	-	3	-	pF
C <sub>O</sub>	output capacitance	V <sub>O</sub> = 0 V or V <sub>CC</sub>	-	9	-	pF
<b>V<sub>CC</sub> = 3.3 V ± 0.3 V</b>						
V <sub>IK</sub>	input clamping voltage	V <sub>CC</sub> = 3.0 V; I <sub>IK</sub> = -18 mA	-	-0.85	-1.2	V
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 3.3 V ± 0.3 V	2.0	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 3.3 V ± 0.3 V	-	-	0.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>CC</sub> = 3.3 V ± 0.3 V; I <sub>O</sub> = -100 μA	V <sub>CC</sub> - 0.2	V <sub>CC</sub>	-	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = -32 mA	2.0	2.3	-	V

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
V <sub>OL</sub>	LOW-level output voltage	V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = 100 μA	-	0.07	0.2	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = 16 mA	-	0.25	0.4	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = 32 mA	-	0.3	0.5	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = 64 mA	-	0.4	0.55	V
I <sub>I</sub>	input leakage current	all input pins <sup>[2]</sup>				
		V <sub>CC</sub> = 0 V or 3.6 V; V <sub>I</sub> = 5.5 V	-	0.1	10	μA
		control pins				
		V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND	-	0.1	±1	μA
		data pins <sup>[2]</sup>				
		V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub>	-	0.5	1	μA
		V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = 0 V	-	0.1	-5	μA
I <sub>OFF</sub>	power-off leakage 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>BHL</sub>	bus hold LOW current	data inputs; V <sub>CC</sub> = 3 V; V <sub>I</sub> = 0.8 V	75	130	-	μA
I <sub>BHH</sub>	bus hold HIGH current	data inputs; V <sub>CC</sub> = 3 V; V <sub>I</sub> = 2.0 V	-75	-140	-	μA
I <sub>BHLO</sub>	bus hold LOW overdrive current	data inputs; V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = 0 V to 3.6 V <sup>[7]</sup>	500	-	-	μA
I <sub>BHHO</sub>	bus hold HIGH overdrive current	data inputs; V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = 0 V to 3.6 V <sup>[7]</sup>	-500	-	-	μA
I <sub>EX</sub>	external current	output in 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	-	10	125	μA
I <sub>O(pu/pd)</sub>	power-up/power-down output current	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> ; n <sub>O</sub> $\overline{E}$ = don't care <sup>[8]</sup>	-	1	±100	μA
I <sub>OZ</sub>	OFF-state output current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>				
		output HIGH: V <sub>O</sub> = 3.0V	-	0.5	5	μA
		output LOW: V <sub>O</sub> = 0.5 V	-	0.5	-5	μA
I <sub>CC</sub>	supply current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A				
		outputs HIGH	-	0.05	0.1	mA
		outputs LOW	-	3.6	5	mA
		outputs disabled <sup>[5]</sup>	-	0.06	0.1	mA
ΔI <sub>CC</sub>	additional supply current	per input pin; V <sub>CC</sub> = 3 V to 3.6 V; one input at V <sub>CC</sub> - 0.6 V; other inputs at V <sub>CC</sub> or GND <sup>[6]</sup>	-	0.04	0.4	mA
C <sub>I</sub>	input capacitance	n <sub>O</sub> $\overline{E}$ ; V <sub>I</sub> = 0 V or V <sub>CC</sub>	-	3	-	pF
C <sub>O</sub>	output capacitance	V <sub>O</sub> = 0 V or V <sub>CC</sub>	-	9	-	pF

[1] Typical values for V<sub>CC</sub> = 2.5 V ± 0.2 V are measured at V<sub>CC</sub> = 2.5 V and T<sub>amb</sub> = 25 °C.

Typical values for V<sub>CC</sub> = 3.3 V ± 0.3 V are measured at V<sub>CC</sub> = 3.3 V and T<sub>amb</sub> = 25 °C.

[2] Unused pins at V<sub>CC</sub> or GND.

[3] Not guaranteed.

[4] 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 ms.

From V<sub>CC</sub> = 1.2 V to V<sub>CC</sub> = 2.5 V ± 0.2 V a transition time of 100 μs is permitted. This parameter is valid for T<sub>amb</sub> = 25 °C only.

[5] I<sub>CC</sub> is measured with outputs pulled to V<sub>CC</sub> or GND.

[6] This is the increase in supply current for each input at the specified voltage level other than V<sub>CC</sub> or GND.

[7] This is the bus hold overdrive current required to force the input to the opposite logic state.

[8] 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 ms.

From V<sub>CC</sub> = 1.2 V to V<sub>CC</sub> = 3.3 V ± 0.3 V a transition time of 100 μs is permitted. This parameter is valid for T<sub>amb</sub> = 25 °C only.

## 10 Dynamic characteristics

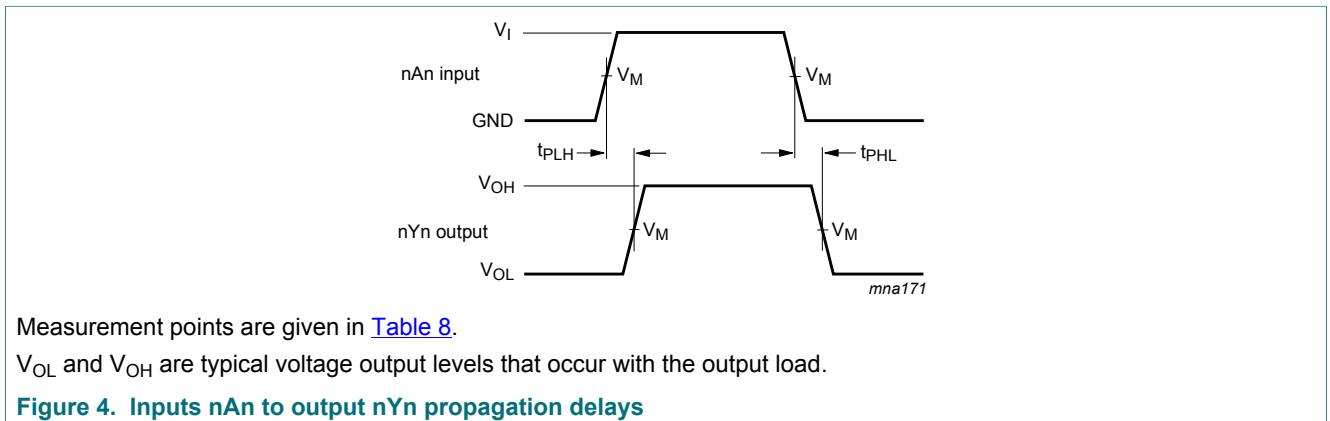
**Table 7. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V);  $T_{amb} = -40\text{ °C}$  to  $+85\text{ °C}$ ; for test circuit see [Figure 6](#).

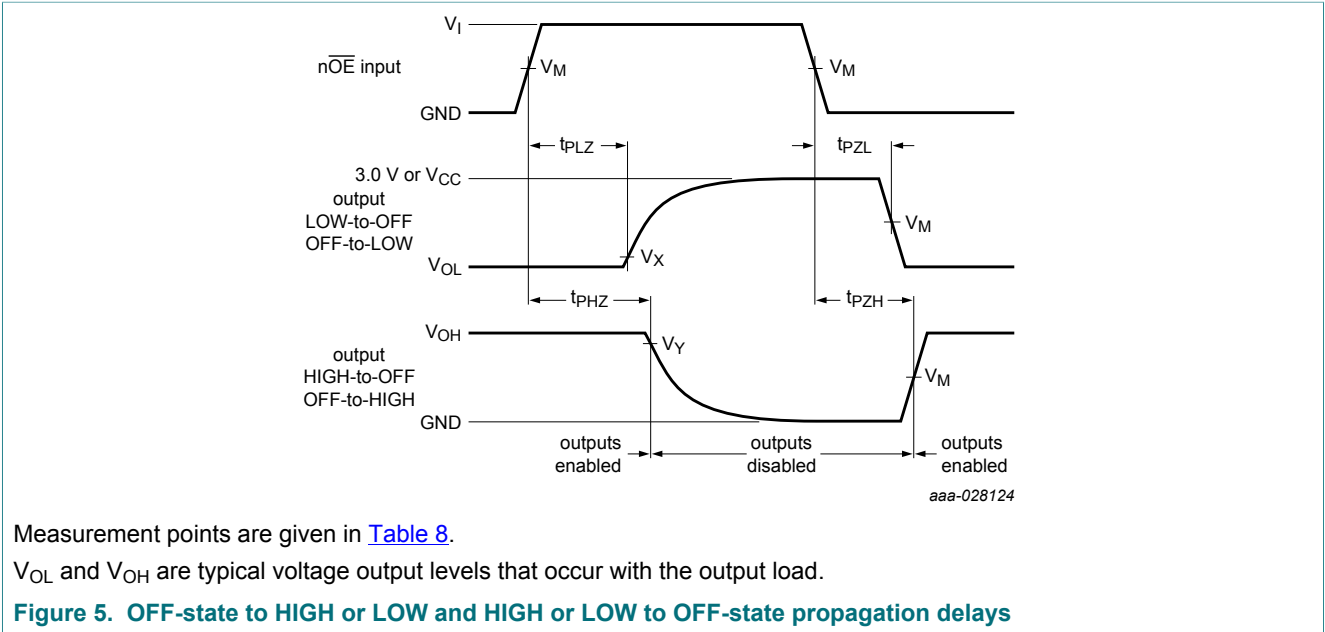
Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
<b><math>V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}</math></b>						
$t_{PLH}$	LOW to HIGH propagation delay	nAn to nYn; see <a href="#">Figure 4</a>	1.0	1.8	3.0	ns
$t_{PHL}$	HIGH to LOW propagation delay	nAn to nYn; see <a href="#">Figure 4</a>	1.0	1.9	3.5	ns
$t_{PZH}$	OFF-state to HIGH propagation delay	$\overline{nOE}$ to nYn; see <a href="#">Figure 5</a>	2.0	3.1	5.9	ns
$t_{PZL}$	OFF-state to LOW propagation delay	$\overline{nOE}$ to nYn; see <a href="#">Figure 5</a>	1.5	2.5	4.7	ns
$t_{PHZ}$	HIGH to OFF-state propagation delay	$\overline{nOE}$ to nYn; see <a href="#">Figure 5</a>	1.5	2.7	4.4	ns
$t_{PLZ}$	LOW to OFF-state propagation delay	$\overline{nOE}$ to nYn; see <a href="#">Figure 5</a>	1.0	2.0	3.4	ns
<b><math>V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}</math></b>						
$t_{PLH}$	LOW to HIGH propagation delay	nAn to nYn; see <a href="#">Figure 4</a>	0.8	1.5	2.4	ns
$t_{PHL}$	HIGH to LOW propagation delay	nAn to nYn; see <a href="#">Figure 4</a>	0.8	1.5	2.5	ns
$t_{PZH}$	OFF-state to HIGH propagation delay	$\overline{nOE}$ to nYn; see <a href="#">Figure 5</a>	1.0	2.3	3.8	ns
$t_{PZL}$	OFF-state to LOW propagation delay	$\overline{nOE}$ to nYn; see <a href="#">Figure 5</a>	0.5	1.8	2.9	ns
$t_{PHZ}$	HIGH to OFF-state propagation delay	$\overline{nOE}$ to nYn; see <a href="#">Figure 5</a>	1.5	2.7	4.2	ns
$t_{PLZ}$	LOW to OFF-state propagation delay	$\overline{nOE}$ to nYn; see <a href="#">Figure 5</a>	1.5	2.3	3.6	ns

[1] Typical values for  $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$  are measured at  $V_{CC} = 2.5\text{ V}$  and  $T_{amb} = 25\text{ °C}$ .  
 Typical values for  $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$  are measured at  $V_{CC} = 3.3\text{ V}$  and  $T_{amb} = 25\text{ °C}$ .

### 10.1 Waveforms and test circuit

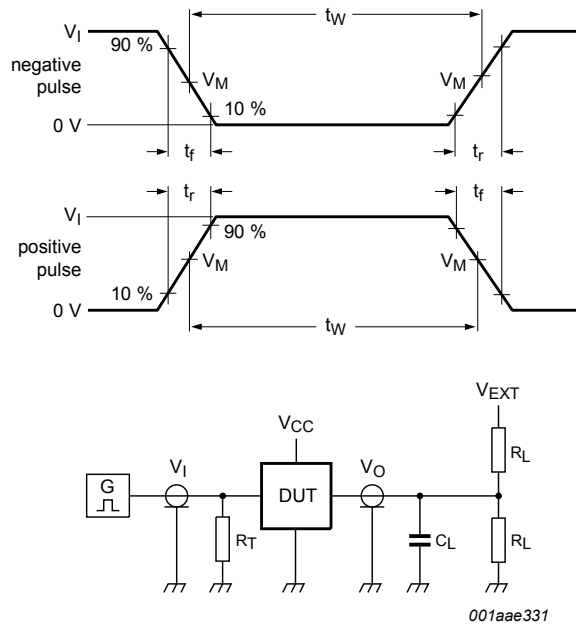






**Table 8. Measurement points**

$V_{CC}$	Input		Output		
	$V_I$	$V_M$	$V_M$	$V_X$	$V_Y$
$V_{CC} \leq 2.7 \text{ V}$	$V_{CC}$	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
$V_{CC} \geq 3.0 \text{ V}$	3.0 V	1.5 V	1.5 V	$V_{OL} + 0.3 \text{ V}$	$V_{OH} - 0.3 \text{ V}$



Test data is given in [Table 9](#).

Definitions for test circuit:

$R_L$  = Load resistance.

$C_L$  = Load capacitance including jig and probe capacitance.

$R_T$  = Termination resistance should be equal to output impedance  $Z_o$  of the pulse generator.

$V_{EXT}$  = External voltage for measuring switching times.

**Figure 6. Test circuit for measuring switching times**

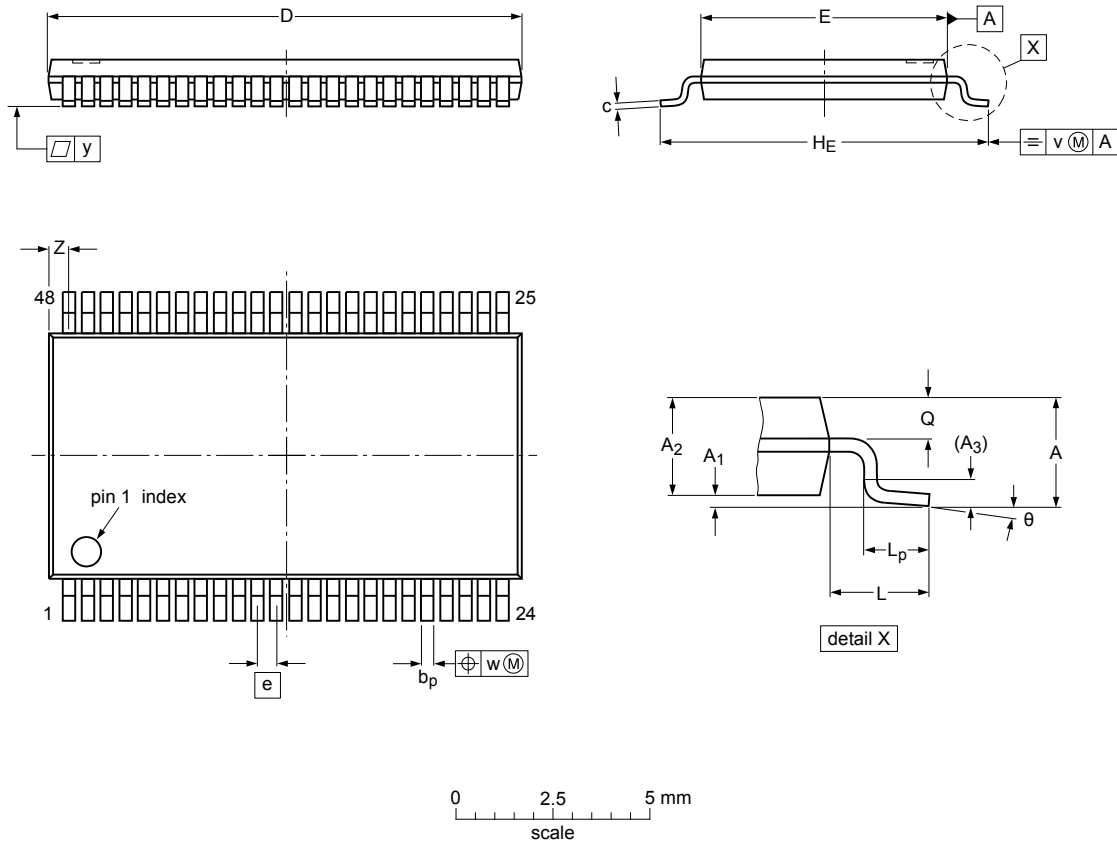
**Table 9. Test data**

Input		Load				$V_{EXT}$		
$V_I$	$f_i$	$t_W$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHZ}, t_{PZH}$	$t_{PLZ}, t_{PZL}$	$t_{PLH}, t_{PHL}$
3.0 V or $V_{CC}$ whichever is less	$\leq 10$ MHz	500 ns	$\leq 2.5$ ns	50 pF	500 $\Omega$	GND	6 V or $V_{CC} \times 2$	open

11 Package outline

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

SOT362-1



Dimensions (mm are the original dimensions)

Unit	A	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	
max		0.15	1.05		0.28	0.2	12.6	6.2		8.3		0.8	0.50		0.25	0.08	0.1	0.8	8°
nom	1.2			0.25					0.5		1								
min		0.05	0.85		0.17	0.1	12.4	6.0		7.9		0.4	0.35				0.4	0°	

Note

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.

sot362-1\_po

Outline version	References			European projection	Issue date
	IEC	JEDEC	JEITA		
SOT362-1		MO-153			03-02-19 13-08-05

Figure 7. Package outline SOT362-1 (TSSOP48)

## 12 Abbreviations

Table 10. Abbreviations

Acronym	Description
BICMOS	Bipolar Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
MIL	Military
MM	Machine Model
TTL	Transistor-Transistor Logic

## 13 Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74ALVT16244 v.5	20180202	Product data sheet	-	74ALVT16244 v.4
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li>Type number 74ALVT16244DL (SOT370-1 / SSOP48) removed.</li> </ul>			
74ALVT16244 v.4	19981007	Product specification	-	74ALVT16244 v.3
74ALVT16244 v.3	19980213	Product specification	-	74ALVT16244 v.2
74ALVT16244 v.2	19980213	Product specification	-	74ALVT16244 v.1
74ALVT16244 v.1	19960529	Product specification	-	-

## 14 Legal information

### 14.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nexperia.com>.

### 14.2 Definitions

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