

# 74ALVCH162244

16-bit buffer/line driver with 30  $\Omega$  termination resistor; 3-State

Rev. 3 — 16 January 2018

Product data sheet

## 1 General description

The 74ALVCH162244 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  $1\overline{OE}$ ,  $2\overline{OE}$ ,  $3\overline{OE}$  and  $4\overline{OE}$ . A HIGH on  $n\overline{OE}$  causes the outputs to assume a high-impedance OFF-state. The 74ALVCH162244 is designed with 30  $\Omega$  series resistors in both HIGH and LOW output states.

The 74ALVCH162244 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.

## 2 Features and benefits

- Wide supply voltage range from 1.2 V to 3.6 V
- 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 (2.7 V to 3.6 V)
- Bus hold on all data inputs
- Integrated 30  $\Omega$  termination resistor
- Complies with JEDEC standards:
  - JESD8-5 (2.3 V to 2.7 V)
  - JESD8B/JESD36 (2.7 V to 3.6 V)
- ESD protection:
  - HBM ANSI/ESDA/JEDEC JS-001 exceeds 2000 V
  - CDM JESD22-C101E exceeds 1000 V

## 3 Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74ALVCH162244DGG	-40 °C to +85 °C	TSSOP48	plastic thin shrink small outline package; 48 leads; body width 6.1 mm	SOT362-1

## 4 Functional diagram

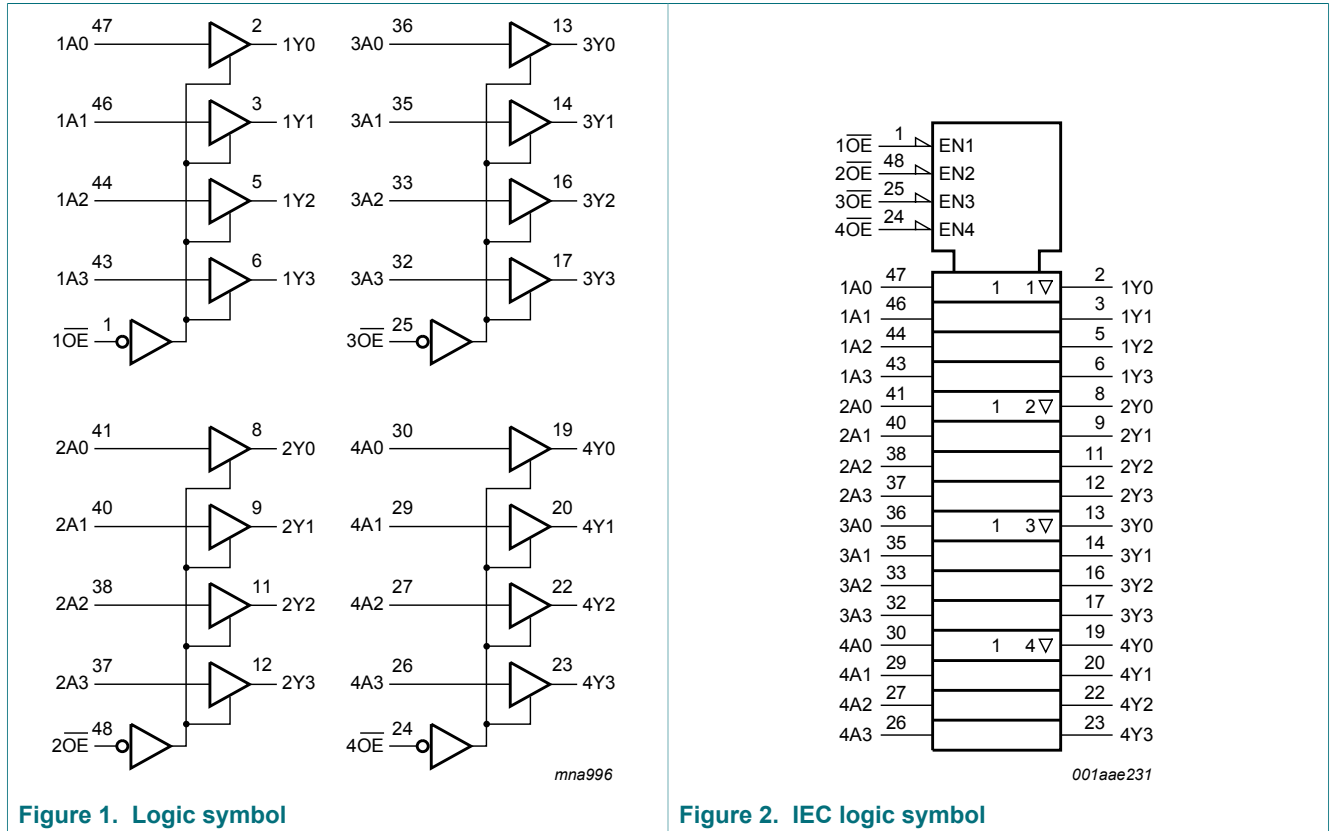


Figure 1. Logic symbol

Figure 2. IEC logic symbol

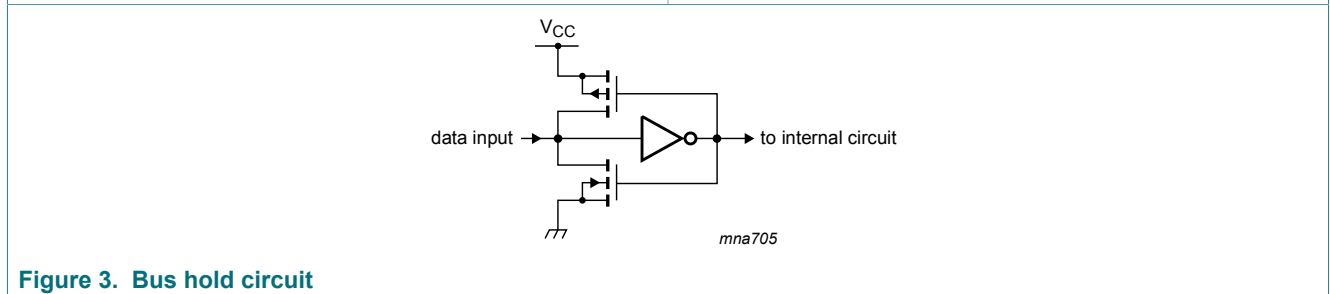


Figure 3. Bus hold circuit

## 5 Pinning information

### 5.1 Pinning

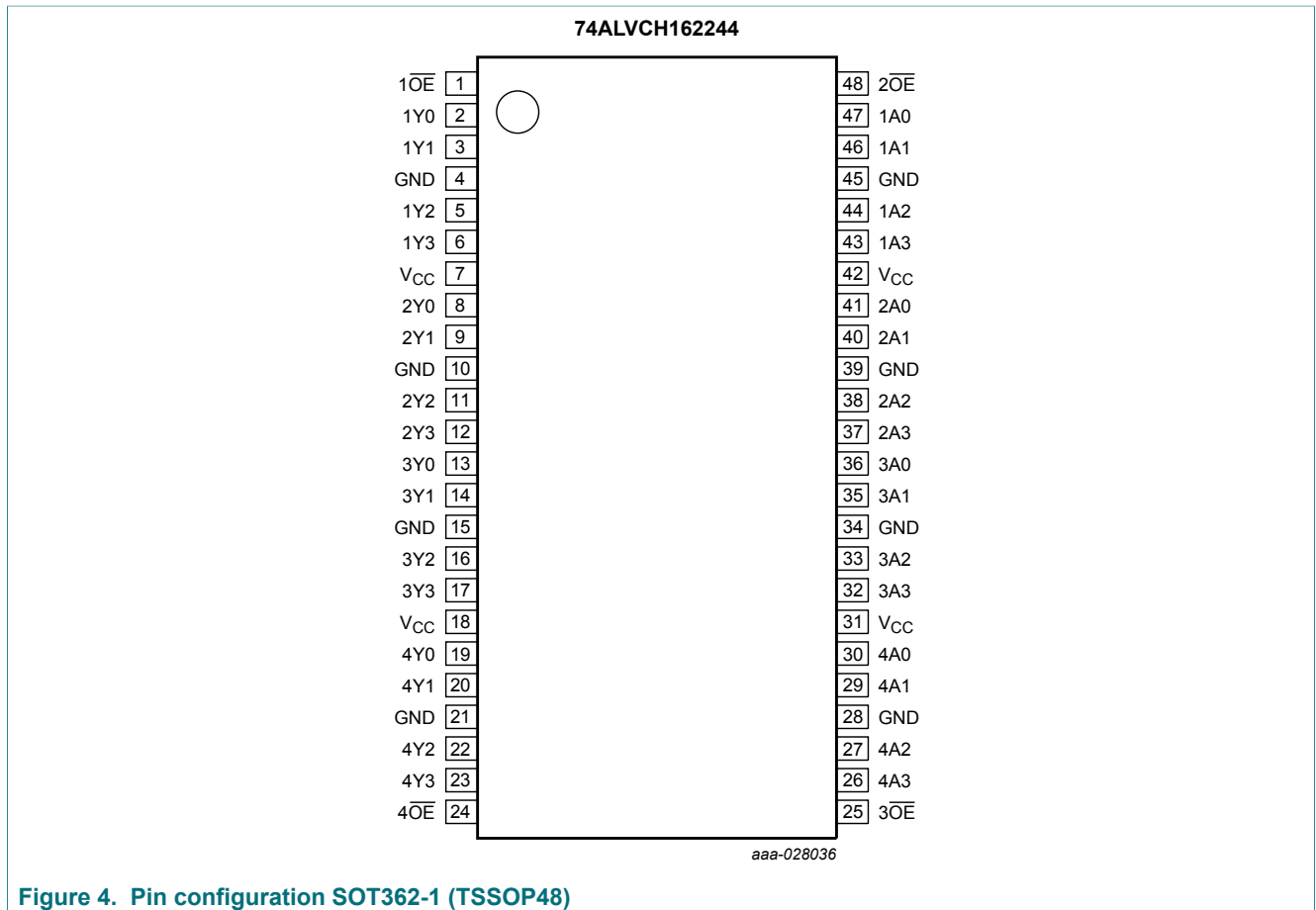


Figure 4. Pin configuration SOT362-1 (TSSOP48)

## 5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
$1\overline{OE}$ , $2\overline{OE}$ , $3\overline{OE}$ , $4\overline{OE}$	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 <sup>[1]</sup>

Input		Output
nOE	nAn	nYn
L	L	L
L	H	H
H	X	Z

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

## 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	data inputs [1]	-0.5	$V_{CC} + 0.5$	V
		control inputs [1]	-0.5	+4.6	V
$V_O$	output voltage	[1]	-0.5	$V_{CC} + 0.5$	V
$I_{IK}$	input clamping current	$V_I < 0$ V	-50	-	mA
$I_{OK}$	output clamping current	$V_O > V_{CC}$ or $V_O < 0$ V	-	$\pm 50$	mA
$I_O$	output current	$V_O = 0$ V to $V_{CC}$	-	$\pm 50$	mA
$I_{CC}$	supply current		-	100	mA
$I_{GND}$	ground current		-100	-	mA
$T_{stg}$	storage temperature		-65	+150	$^{\circ}\text{C}$
$P_{tot}$	total power dissipation	$T_{amb} = -40$ $^{\circ}\text{C}$ to $+85$ $^{\circ}\text{C}$			
		TSSOP48 package [2]	-	600	mW

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

[2] For TSSOP48 packages: above 55  $^{\circ}\text{C}$  derate linearly with 8 mW/K.

## 8 Recommended operating conditions

**Table 5. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC}$	supply voltage	$V_{CC} = 2.5$ V: for maximum speed performance at $C_L = 30$ pF	2.3	2.7	V
		$V_{CC} = 3.3$ V: for maximum speed performance at $C_L = 50$ pF	3.0	3.6	V
$V_I$	input voltage		0	$V_{CC}$	V
$V_O$	output voltage		0	$V_{CC}$	V
$T_{amb}$	ambient temperature	in free air	-40	+85	$^{\circ}\text{C}$
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 2.3$ V to 3.0 V	-	20	ns/V
		$V_{CC} = 3.0$ V to 3.6 V	-	10	ns/V

## 9 Static characteristics

**Table 6. Static characteristics**

At recommended operating conditions. Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 2.3 to 2.7 V	1.7	1.2	-	V
		V <sub>CC</sub> = 2.7 to 3.6 V	2.0	1.5	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 2.3 to 2.7 V	-	1.2	0.7	V
		V <sub>CC</sub> = 2.7 to 3.6 V	-	1.5	0.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		I <sub>O</sub> = -100 $\mu$ A; V <sub>CC</sub> = 2.3 V to 3.6 V	V <sub>CC</sub> - 0.2	V <sub>CC</sub>	-	V
		I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 2.3 V	V <sub>CC</sub> - 0.4	V <sub>CC</sub> - 0.11	-	V
		I <sub>O</sub> = -6 mA; V <sub>CC</sub> = 2.3 V	V <sub>CC</sub> - 0.6	V <sub>CC</sub> - 0.17	-	V
		I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 2.7 V	V <sub>CC</sub> - 0.5	V <sub>CC</sub> - 0.09	-	V
		I <sub>O</sub> = -8 mA; V <sub>CC</sub> = 2.7 V	V <sub>CC</sub> - 0.7	V <sub>CC</sub> - 0.19	-	V
		I <sub>O</sub> = -6 mA; V <sub>CC</sub> = 3.0 V	V <sub>CC</sub> - 0.6	V <sub>CC</sub> - 0.13	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		I <sub>O</sub> = 100 $\mu$ A; V <sub>CC</sub> = 2.3 V to 3.6 V	-	GND	0.20	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 2.3 V	-	0.07	0.40	V
		I <sub>O</sub> = 6 mA; V <sub>CC</sub> = 2.3 V	-	0.11	0.55	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 2.7 V	-	0.06	0.40	V
		I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.7 V	-	0.13	0.60	V
		I <sub>O</sub> = 6 mA; V <sub>CC</sub> = 3.0 V	-	0.09	0.55	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 2.3 V to 3.6 V	-	0.1	5	$\mu$ A
I <sub>BHL</sub>	bus hold LOW current	V <sub>CC</sub> = 2.3 V; V <sub>I</sub> = 0.7 V	45	-	-	$\mu$ A
		V <sub>CC</sub> = 3.0 V; V <sub>I</sub> = 0.8 V	75	150	-	$\mu$ A
I <sub>BHH</sub>	bus hold HIGH current	V <sub>CC</sub> = 2.3 V; V <sub>I</sub> = 1.7 V	-45	-	-	$\mu$ A
		V <sub>CC</sub> = 3.0 V; V <sub>I</sub> = 2.0 V	-75	-175	-	$\mu$ A
I <sub>BHLO</sub>	bus hold LOW overdrive current	V <sub>CC</sub> = 3.6 V	500	-	-	$\mu$ A
I <sub>BHHO</sub>	bus hold HIGH overdrive current	V <sub>CC</sub> = 3.6 V	-500	-	-	$\mu$ A
I <sub>OZ</sub>	OFF-state output current	V <sub>CC</sub> = 2.3 V to 3.6 V; 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	$\mu$ A
I <sub>CC</sub>	supply current	V <sub>CC</sub> = 2.3 to 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A	-	0.2	40	$\mu$ A
$\Delta$ I <sub>CC</sub>	additional supply current	V <sub>CC</sub> = 2.3 V to 3.6 V; V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A	-	150	750	$\mu$ A
C <sub>I</sub>	input capacitance		-	5.0	-	pF

[1] All typical values are measured at T<sub>amb</sub> = 25 °C.

## 10 Dynamic characteristics

**Table 7. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); For test circuit, see [Figure 7](#).

Symbol	Parameter	Conditions	T <sub>amb</sub> = -40 °C to +85 °C			Unit
			Min	Typ <sup>[1]</sup>	Max	
t <sub>pd</sub>	propagation delay	nAn to nYn; see <a href="#">Figure 5</a> <sup>[2]</sup>				
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	3.0	4.9	ns
		V <sub>CC</sub> = 2.7 V	1.0	3.3	4.7	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	2.7	4.2	ns
t <sub>en</sub>	enable time	n $\overline{\text{OE}}$ to nYn; see <a href="#">Figure 6</a> <sup>[3]</sup>				
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	4.0	6.8	ns
		V <sub>CC</sub> = 2.7 V	1.0	4.6	6.7	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	3.5	5.6	ns
t <sub>dis</sub>	disable time	n $\overline{\text{OE}}$ to nYn; see <a href="#">Figure 6</a> <sup>[4]</sup>				
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	2.3	6.3	ns
		V <sub>CC</sub> = 2.7 V	1.0	3.2	5.7	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	2.9	5.5	ns
C <sub>PD</sub>	power dissipation capacitance	per buffer; V <sub>I</sub> = GND to V <sub>CC</sub> <sup>[5]</sup>				
		outputs enabled	-	25	-	pF
		outputs disabled	-	4	-	pF

[1] Typical values are measured at T<sub>amb</sub> = 25 °C

Typical values for V<sub>CC</sub> = 2.3 V to 2.7 V are measured at V<sub>CC</sub> = 2.5 V

Typical values for V<sub>CC</sub> = 3.0 V to 3.6 V are measured at V<sub>CC</sub> = 3.3 V

[2] t<sub>pd</sub> is the same as t<sub>PHL</sub> and t<sub>PLH</sub>.

[3] t<sub>en</sub> is the same as t<sub>PZH</sub> and t<sub>PZL</sub>.

[4] t<sub>dis</sub> is the same as t<sub>PHZ</sub> and t<sub>PLZ</sub>.

[5] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).

$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$  where:

f<sub>i</sub> = input frequency in MHz

f<sub>o</sub> = output frequency in MHz

C<sub>L</sub> = output load capacitance in pF

V<sub>CC</sub> = supply voltage in Volts

N = number of inputs switching;

$\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs

10.1 Waveforms and test circuit

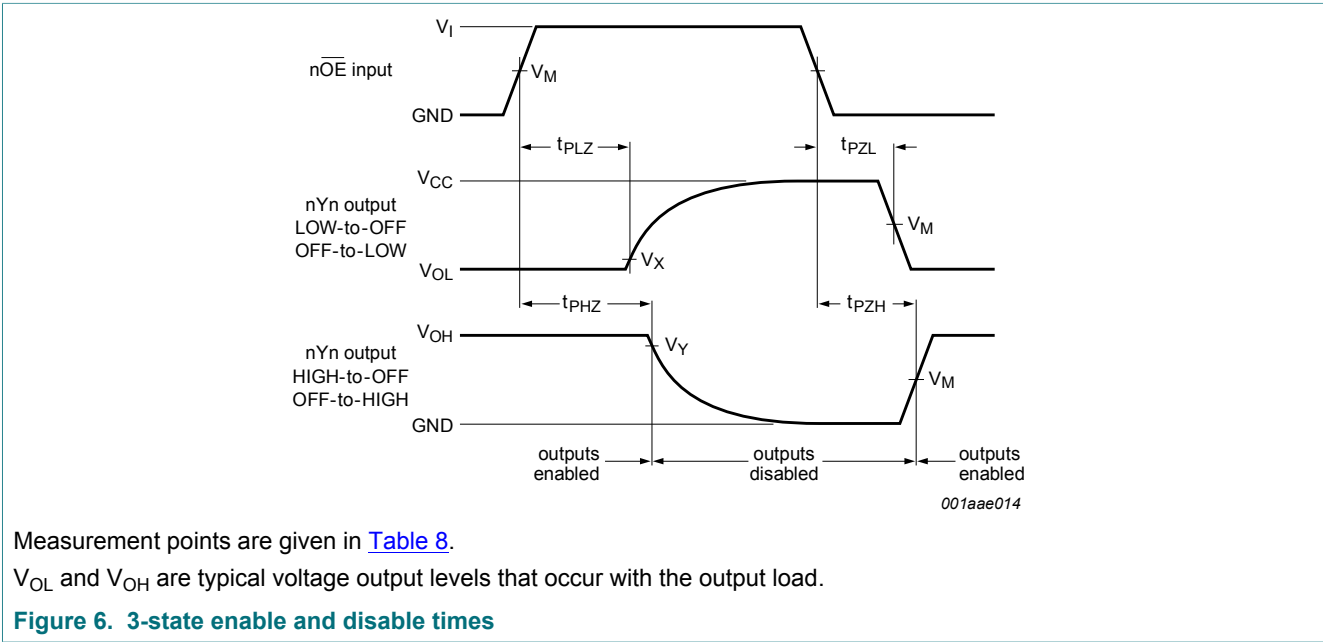
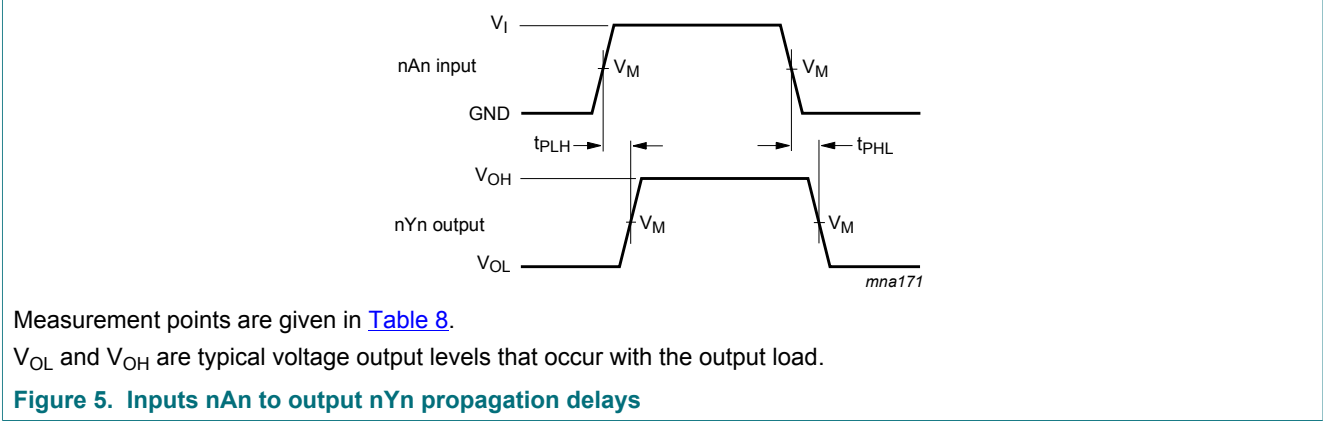


Table 8. Measurement points

Supply voltage	Input	Output			
$V_{CC}$	$V_I$	$V_M$	$V_M$	$V_X$	$V_Y$
2.3 V to 2.7 V	$V_{CC}$	$0.5 \times V_{CC}$	$0.5V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
2.7 V	2.7 V	1.5 V	1.5 V	$V_{OL} + 0.3 \text{ V}$	$V_{OH} - 0.3 \text{ V}$
3.0 V to 3.6 V	2.7 V	1.5 V	1.5 V	$V_{OL} + 0.3 \text{ V}$	$V_{OH} - 0.3 \text{ V}$



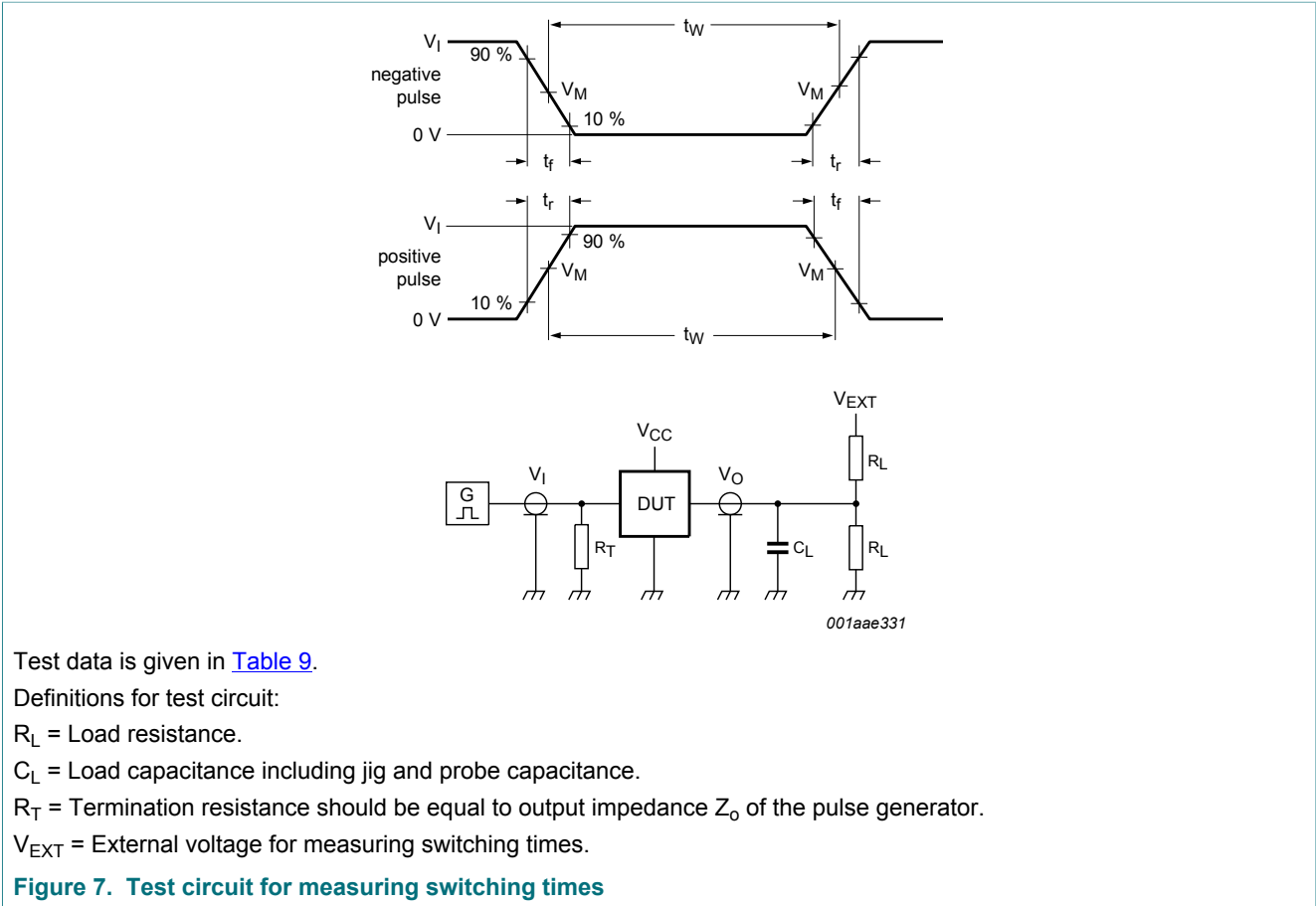


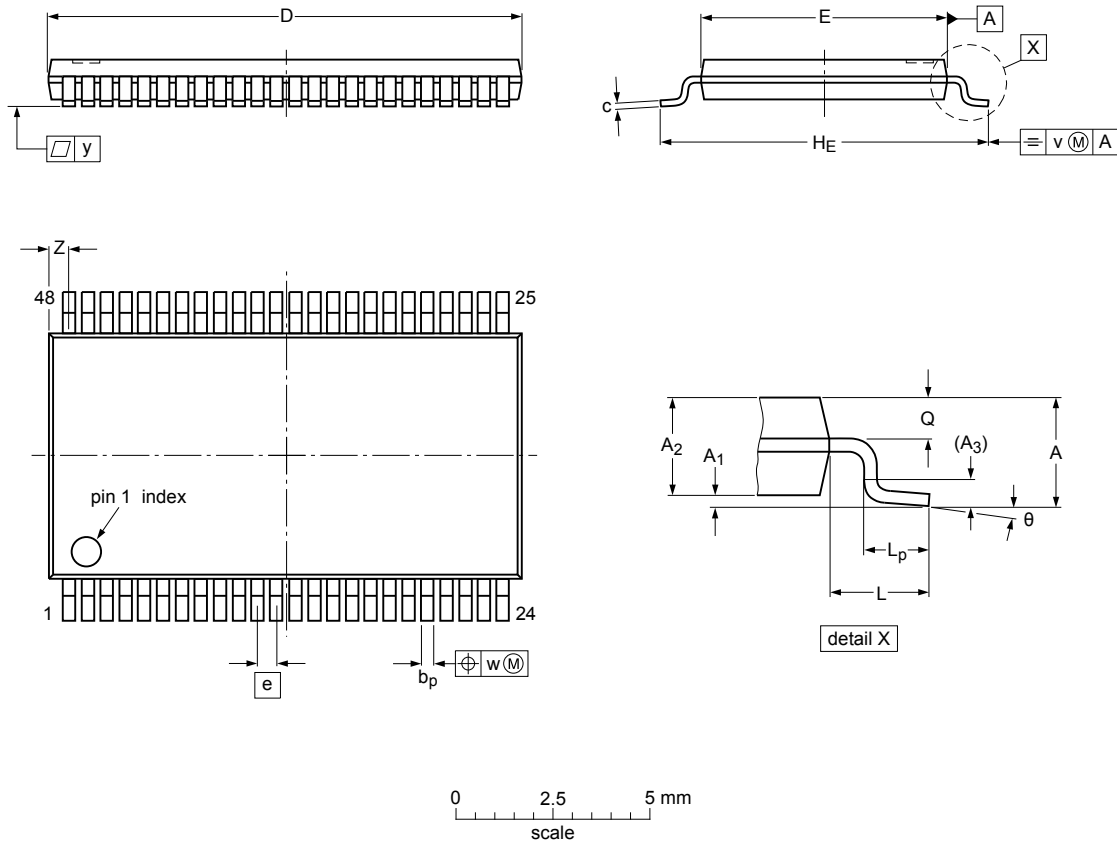
Table 9. Test data

Supply voltage	Input		Load		$V_{EXT}$		
$V_{CC}$	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PLH}, t_{PHL}$	$t_{PLZ}, t_{PZL}$	$t_{PHZ}, t_{PZH}$
2.3 V to 2.7 V	$V_{CC}$	$\leq 2.0$ ns	30 pF	500 Ω	open	$2 \times V_{CC}$	GND
2.7 V	2.7 V	$\leq 2.5$ ns	50 pF	500 Ω	open	$2 \times V_{CC}$	GND
3.0 V to 3.6 V	2.7 V	$\leq 2.5$ ns	50 pF	500 Ω	open	$2 \times V_{CC}$	GND

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 8. Package outline SOT362-1 (TSSOP48)

## 12 Abbreviations

Table 10. Abbreviations

Acronym	Description
CDM	Charged Device Model
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
TTL	Transistor-Transistor Logic

## 13 Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74ALVCH162244 v.3	20180116	Product data sheet	-	74ALVCH162244 v.2
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 74ALVCH162244DL (SOT370-1 / SSOP48) removed.</li> </ul>			
74ALVCH162244 v.2	19980629	Product specification	-	74ALVCH162244 v.1
74ALVCH162244 v.1	19980423	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".

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Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.

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