

# 74ALVT16827

20-bit buffer/line driver; non-inverting; 3-state

Rev. 4 — 24 January 2018

Product data sheet

## 1 General description

The 74ALVT16827 high-performance BiCMOS device combines low static and dynamic power dissipation with high speed and high output drive. It is designed for  $V_{CC}$  operation at 2.5 V or 3.3 V with I/O compatibility to 5 V.

The 74ALVT16827 20-bit buffers provide high performance bus interface buffering for wide data/address paths or buses carrying parity. They have NOR Output Enables ( $\overline{nOE0}$  and  $\overline{nOE1}$ ) for maximum control flexibility.

## 2 Features and benefits

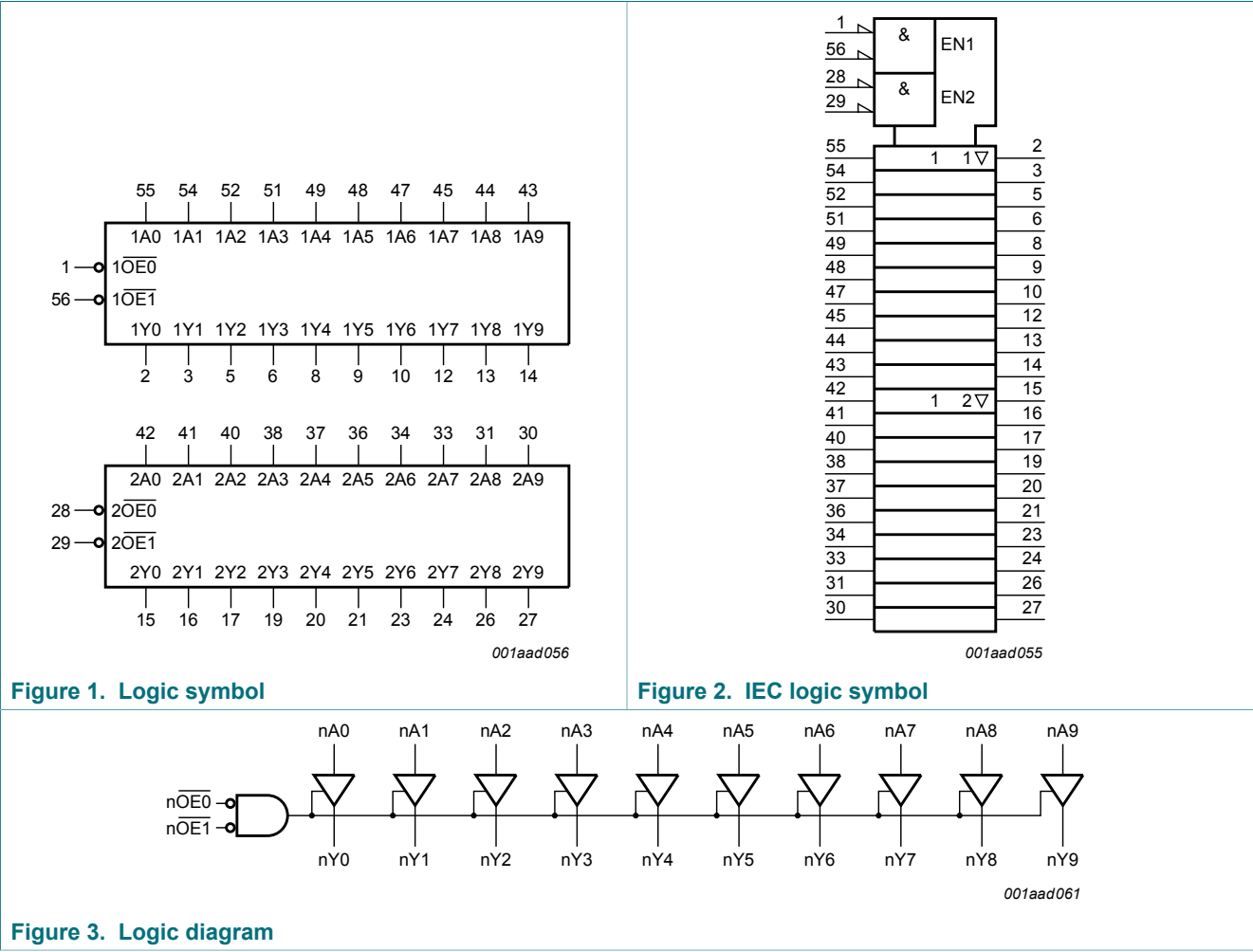
- Multiple  $V_{CC}$  and GND pins minimize switching noise
- 5 V I/O compatible
- Live insertion and extraction permitted
- 3-state output buffers
- Power-up 3-state
- Output capability: +64 mA and -32 mA
- Latch-up protection:
  - JESD 78 exceeds 500 mA
- ESD protection:
  - MIL STD 883 Method 3015: exceeds 2000 V
  - MM: exceeds 200 V
- Bus hold data inputs eliminate need for external pull-up resistors to hold unused inputs.

## 3 Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74ALVT16827DGG	-40 °C to +85 °C	TSSOP56	plastic thin shrink small outline package; 56 leads; body width 6.1 mm	SOT364-1

4 Functional diagram



5 Pinning information

5.1 Pinning

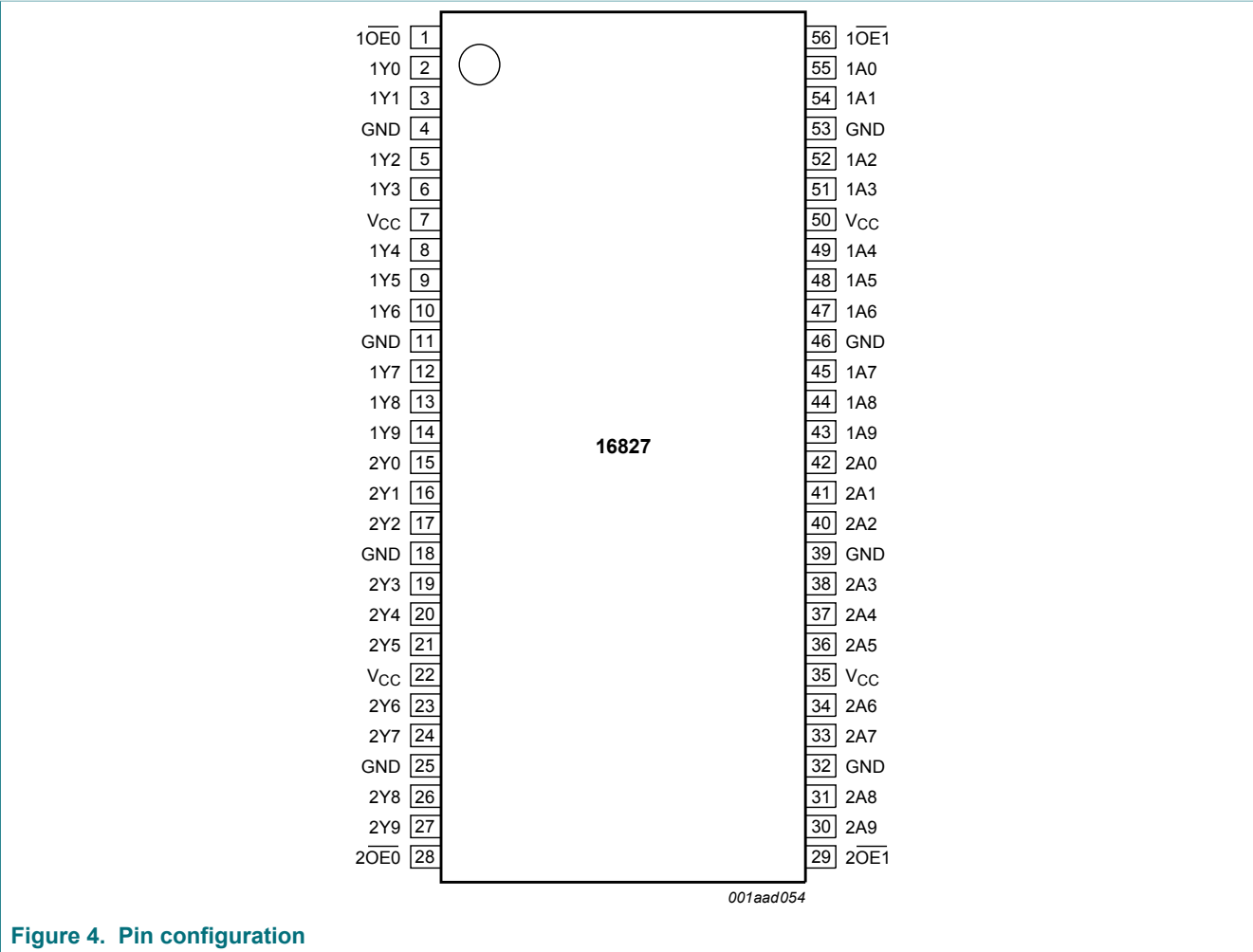


Figure 4. Pin configuration

## 5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
1A0, 1A1, 1A2, 1A3, 1A4, 1A5, 1A6, 1A7, 1A8, 1A9	55, 54, 52, 51, 49, 48, 47, 45, 44, 43	data input
2A0, 2A1, 2A2, 2A3, 2A4, 2A5, 2A6, 2A7, 2A8, 2A9	42, 41, 40, 38, 37, 36, 34, 33, 31, 30	data input
1Y0, 1Y1, 1Y2, 1Y3, 1Y4, 1Y5, 1Y6, 1Y7, 1Y8, 1Y9	2, 3, 5, 6, 8, 9, 10, 12, 13, 14	data output
2Y0, 2Y1, 2Y2, 2Y3, 2Y4, 2Y5, 2Y6, 2Y7, 2Y8, 2Y9	15, 16, 17, 19, 20, 21, 23, 24, 26, 27	data output
1 $\overline{OE}0$ , 1 $\overline{OE}1$ , 2 $\overline{OE}0$ , 2 $\overline{OE}1$	1, 56, 28, 29	output enable inputs (active-LOW)
GND	4, 11, 18, 25, 32, 39, 46, 53	ground (0 V)
V <sub>CC</sub>	7, 22, 35, 50	positive voltage supply

## 6 Functional description

Table 3. Function table <sup>[1]</sup>

Input		Output	Operating mode
n $\overline{OE}n$	nAn	nYn	
L	L	L	transparent
L	H	H	transparent
H	X	Z	High-impedance

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

## 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 <sub>CC</sub>	supply voltage		-0.5	+7.0	V
V <sub>I</sub>	input voltage		<sup>[1]</sup> -1.2	+7.0	V
V <sub>O</sub>	output voltage	output in OFF or HIGH-state	<sup>[1]</sup> -0.5	+5.5	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < 0 V	-18	-	mA
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < 0 V	-50	-	mA
I <sub>O</sub>	output current	output in LOW-state	-	128	mA
T <sub>j</sub>	junction temperature		<sup>[2]</sup> -	150	°C
T <sub>stg</sub>	storage temperature		-65	+150	°C

[1] The input and output voltage ratings may be exceeded if the input and output 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 $\leq 50\%$ ; $f \geq 1\text{ kHz}$	-	24	-	64	mA
$\Delta t/\Delta V$	input transition rise and fall rate	outputs enabled	-	10	-	10	ns/V
$T_{amb}$	ambient temperature		-40	+85	-40	+85	°C

## 9 Static characteristics

Table 6. Static characteristics

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

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
$V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$						
$V_{IK}$	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		1.7	-	-	V
$V_{IL}$	LOW-level input voltage		-	-	0.7	V
$V_{OH}$	HIGH-level output voltage	$V_{CC} = 2.3\text{ V}$ to $2.7\text{ V}$ ; $I_O = -100\text{ }\mu\text{A}$	$V_{CC} - 0.2$	$V_{CC}$	-	V
		$V_{CC} = 2.3\text{ V}$ ; $I_O = -8\text{ mA}$	1.8	2.1	-	V
$V_{OL}$	LOW-level output voltage	$V_{CC} = 2.3\text{ V}$ ; $I_O = 100\text{ }\mu\text{A}$	-	0.07	0.2	V
		$V_{CC} = 2.3\text{ V}$ ; $I_O = 24\text{ mA}$	-	0.3	0.5	V
$I_I$	input leakage current	all pins				
		$V_{CC} = 0\text{ V}$ or $2.7\text{ V}$ ; $V_I = 5.5\text{ V}$	-	0.1	10	$\mu\text{A}$
		control pins				
		$V_{CC} = 2.7\text{ V}$ ; $V_I = V_{CC}$ or GND	-	0.1	$\pm 1$	$\mu\text{A}$
		data pins <sup>[2]</sup>				
		$V_{CC} = 2.7\text{ V}$ ; $V_I = V_{CC}$	-	0.1	1	$\mu\text{A}$
		$V_{CC} = 2.7\text{ V}$ ; $V_I = 0\text{ V}$	-	0.1	-5	$\mu\text{A}$
$I_{OFF}$	power-off leakage current	$V_{CC} = 0\text{ V}$ ; $V_I$ or $V_O = 0\text{ V}$ to $4.5\text{ V}$	-	0.1	$\pm 100$	$\mu\text{A}$
$I_{BHL}$	bus hold LOW current	$V_{CC} = 2.5\text{ V}$ ; $V_I = 0.8\text{ V}$	-	115	-	$\mu\text{A}$
$I_{BHH}$	bus hold HIGH current	$V_{CC} = 2.5\text{ V}$ ; $V_I = 2.0\text{ V}$	-	-10	-	$\mu\text{A}$

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
$I_{EX}$	external current	output in HIGH-state when $V_O > V_{CC}$ ; $V_O = 5.5\text{ V}$ ; $V_{CC} = 2.3\text{ V}$	-	10	125	$\mu\text{A}$
$I_{O(pu/pd)}$	power-up/power-down output current	$V_{CC} \leq 1.2\text{ V}$ ; $V_O = 0.5\text{ V to } V_{CC}$ ; $V_I = \text{GND or } V_{CC}$ ; $\overline{nOE} = \text{don't care}$ <sup>[3]</sup>	-	1	100	$\mu\text{A}$
$I_{OZ}$	OFF-state output current	$V_{CC} = 2.7\text{ V}$ ; $V_I = V_{IL}$ or $V_{IH}$				
		output HIGH; $V_O = 2.3\text{ V}$	-	0.5	5	$\mu\text{A}$
		output LOW; $V_O = 0.5\text{ V}$	-	0.5	-5	$\mu\text{A}$
$I_{CC}$	supply current	$V_{CC} = 2.7\text{ V}$ ; $V_I = \text{GND or } V_{CC}$ ; $I_O = 0\text{ A}$				
		outputs HIGH	-	0.04	0.1	mA
		outputs LOW	-	3.6	5.0	mA
		outputs disabled <sup>[4]</sup>	-	0.04	0.1	mA
$\Delta I_{CC}$	additional supply current	per input pin; $V_{CC} = 2.3\text{ V to } 2.7\text{ V}$ ; one input at $V_{CC} - 0.6\text{ V}$ ; other inputs at $V_{CC}$ or GND <sup>[5]</sup>	-	0.04	0.4	mA
$C_I$	input capacitance	$V_I = 0\text{ V or } V_{CC}$	-	3	-	pF
$C_O$	output capacitance	$V_O = 0\text{ V or } V_{CC}$	-	9	-	pF
<b><math>V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}</math></b>						
$V_{IK}$	input clamping voltage	$V_{CC} = 3.0\text{ V}$ ; $I_{IK} = -18\text{ mA}$	-	-0.85	-1.2	V
$V_{IH}$	HIGH-level input voltage		2.0	-	-	V
$V_{IL}$	LOW-level input voltage		-	-	0.8	V
$V_{OH}$	HIGH-level output voltage	$V_{CC} = 3.0\text{ V to } 3.6\text{ V}$ ; $I_O = -100\text{ }\mu\text{A}$	$V_{CC} - 0.2$	$V_{CC}$	-	V
		$V_{CC} = 3.0\text{ V}$ ; $I_O = -32\text{ mA}$	2.0	2.3	-	V
$V_{OL}$	LOW-level output voltage	$V_{CC} = 3.0\text{ V}$				
		$I_O = 100\text{ }\mu\text{A}$	-	0.07	0.2	V
		$I_O = 16\text{ mA}$	-	0.25	0.4	V
		$I_O = 32\text{ mA}$	-	0.3	0.5	V
		$I_O = 64\text{ mA}$	-	0.4	0.55	V
$I_I$	input leakage current	control pins				
		$V_{CC} = 3.6\text{ V}$ ; $V_I = V_{CC}$ or GND	-	0.1	$\pm 1$	$\mu\text{A}$
		$V_{CC} = 0\text{ V or } 3.6\text{ V}$ ; $V_I = 5.5\text{ V}$	-	0.1	10	$\mu\text{A}$
		data pins <sup>[2]</sup>				
		$V_{CC} = 3.6\text{ V}$ ; $V_I = V_{CC}$	-	0.5	1	$\mu\text{A}$
		$V_{CC} = 3.6\text{ V}$ ; $V_I = 0\text{ V}$	-	0.1	-5	$\mu\text{A}$
$I_{OFF}$	power-off leakage current	$V_{CC} = 0\text{ V}$ ; $V_I$ or $V_O = 0\text{ V to } 4.5\text{ V}$	-	0.1	$\pm 100$	$\mu\text{A}$
$I_{BHL}$	bus hold LOW current	data inputs; $V_{CC} = 3\text{ V}$ ; $V_I = 0.8\text{ V}$	75	130	-	$\mu\text{A}$
$I_{BHH}$	bus hold HIGH current	data inputs; $V_{CC} = 3\text{ V}$ ; $V_I = 2.0\text{ V}$	-75	-140	-	$\mu\text{A}$
$I_{BHLO}$	bus hold LOW overdrive current	data inputs; $V_{CC} = 3.6\text{ V}$ ; $V_I = 0\text{ V to } 3.6\text{ V}$ <sup>[6]</sup>	500	-	-	$\mu\text{A}$

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
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>[6]</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>OE</sub> n = don't care <sup>[7]</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> = 3.0 V	-	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	-	0.07	0.1	mA
		outputs LOW	-	4.2	6	mA
		outputs disabled <sup>[4]</sup>	-	0.07	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>[5]</sup>	-	0.04	0.4	mA
C <sub>I</sub>	input capacitance	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] All 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.

All 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] 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.

[4] I<sub>CC</sub> with outputs disabled is measured with outputs pulled up to V<sub>CC</sub> or pulled down to ground.

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

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

[7] 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**

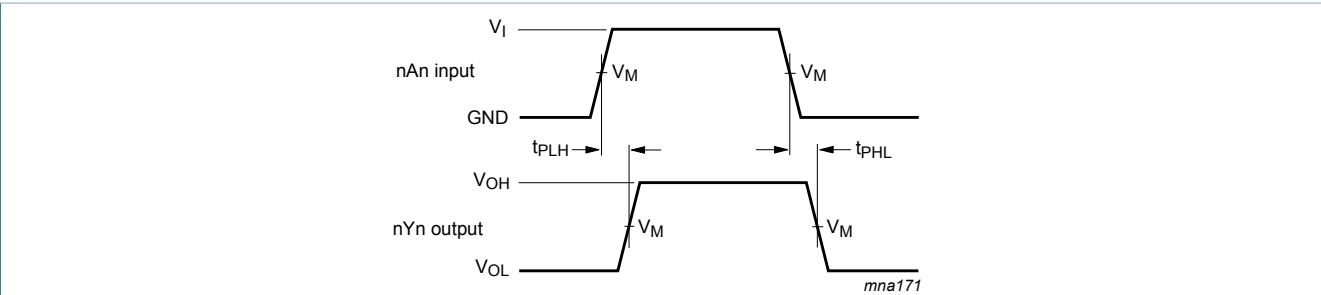
At recommended operating conditions; T<sub>amb</sub> = -40 °C to +85 °C; Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 7](#).

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
<b>V<sub>CC</sub> = 2.5 V ± 0.2 V</b>						
t <sub>PLH</sub>	LOW to HIGH propagation delay	nAn to nYn; see <a href="#">Figure 5</a>	1.0	2.0	2.9	ns
t <sub>PHL</sub>	HIGH to LOW propagation delay	nAn to nYn; see <a href="#">Figure 5</a>	1.0	2.0	3.0	ns
t <sub>PZH</sub>	OFF-state to HIGH propagation delay	n <sub>OE</sub> n to nYn; see <a href="#">Figure 6</a>	2.0	3.2	5.5	ns
t <sub>PZL</sub>	OFF-state to LOW propagation delay	n <sub>OE</sub> n to nYn; see <a href="#">Figure 6</a>	1.7	2.9	4.3	ns
t <sub>PHZ</sub>	HIGH to OFF-state propagation delay	n <sub>OE</sub> n to nYn; see <a href="#">Figure 6</a>	1.8	2.8	5.1	ns
t <sub>PLZ</sub>	LOW to OFF-state propagation delay	n <sub>OE</sub> n to nYn; see <a href="#">Figure 6</a>	1.4	2.3	3.9	ns
<b>V<sub>CC</sub> = 3.3 V ± 0.3 V</b>						
t <sub>PLH</sub>	LOW to HIGH propagation delay	nAn to nYn; see <a href="#">Figure 5</a>	0.7	1.5	2.2	ns
t <sub>PHL</sub>	HIGH to LOW propagation delay	nAn to nYn; see <a href="#">Figure 5</a>	0.8	1.6	2.3	ns

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
t <sub>PZH</sub>	OFF-state to HIGH propagation delay	n $\overline{\text{OEn}}$ to nYn; see Figure 6	1.6	2.6	3.8	ns
t <sub>PZL</sub>	OFF-state to LOW propagation delay	n $\overline{\text{OEn}}$ to nYn; see Figure 6	1.4	2.3	3.2	ns
t <sub>PHZ</sub>	HIGH to OFF-state propagation delay	n $\overline{\text{OEn}}$ to nYn; see Figure 6	2.3	3.2	4.8	ns
t <sub>PLZ</sub>	LOW to OFF-state propagation delay	n $\overline{\text{OEn}}$ to nYn; see Figure 6	1.5	2.5	3.8	ns

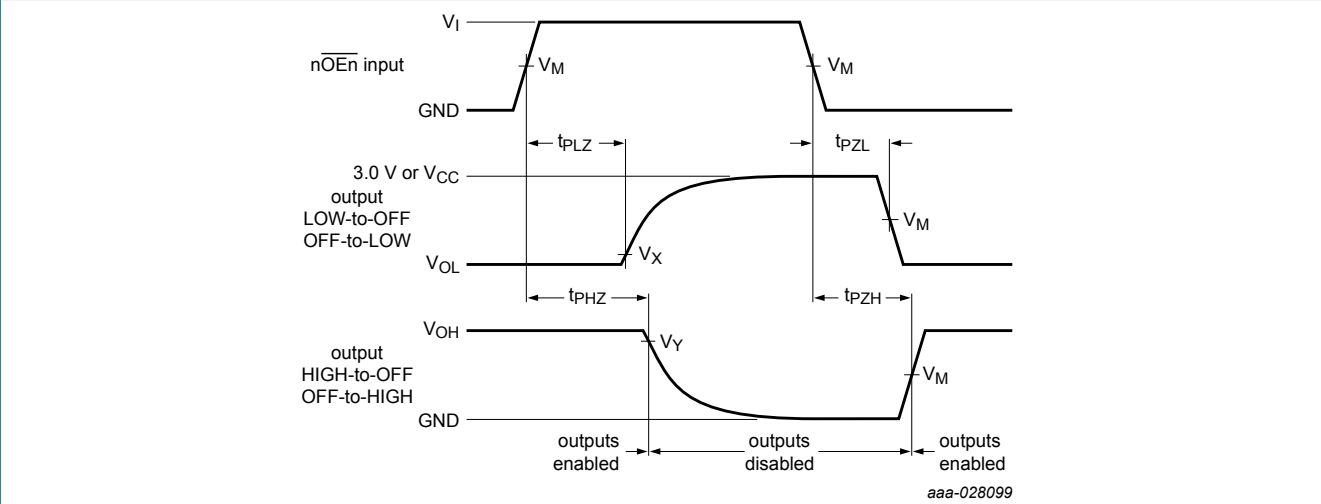
[1] All typical values for V<sub>CC</sub> = 2.5 V ± 0.2 V are measured at V<sub>CC</sub> = 2.5 V and T<sub>amb</sub> = 25 °C.  
All typical values for V<sub>CC</sub> = 3.3 V ± 0.3 V are measured at V<sub>CC</sub> = 3.3 V and T<sub>amb</sub> = 25 °C.

10.1 Waveforms and test circuit



Measurement points are given in Table 8.  
VOL and VOH are typical voltage output levels that occur with the output load.

Figure 5. Input (nAn) to output (nYn) propagation delays



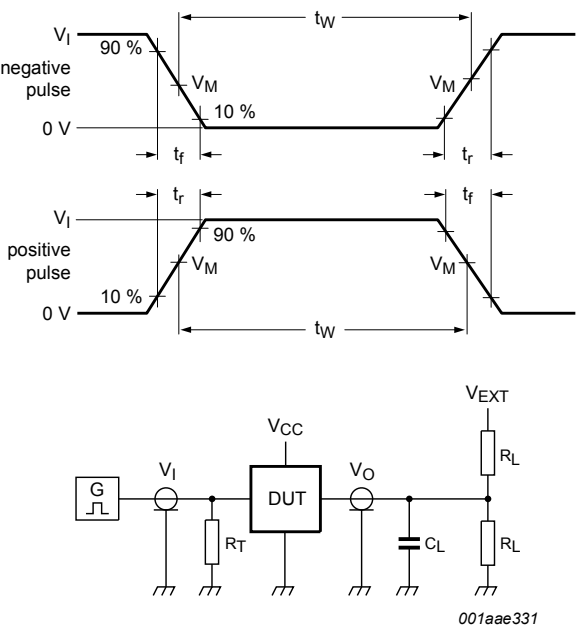
Measurement points are given in Table 8.  
VOL and VOH are typical voltage output levels that occur with the output load.

Figure 6. The 3-state output enable and disable times

Table 8. Measurement points

V <sub>CC</sub>	Input		Output		
	V <sub>I</sub>	V <sub>M</sub>	V <sub>M</sub>	V <sub>X</sub>	V <sub>Y</sub>
V <sub>CC</sub> ≤ 2.7 V	V <sub>CC</sub>	0.5 x V <sub>CC</sub>	0.5 x V <sub>CC</sub>	V <sub>OL</sub> + 0.15 V	V <sub>OH</sub> - 0.15 V
V <sub>CC</sub> ≥ 3.0 V	3.0 V	1.5 V	1.5 V	V <sub>OL</sub> + 0.3 V	V <sub>OH</sub> - 0.3 V





Test data is given in [Table 9](#).  
Definitions 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.  
 $V_{EXT}$  = Test voltage for switching times.

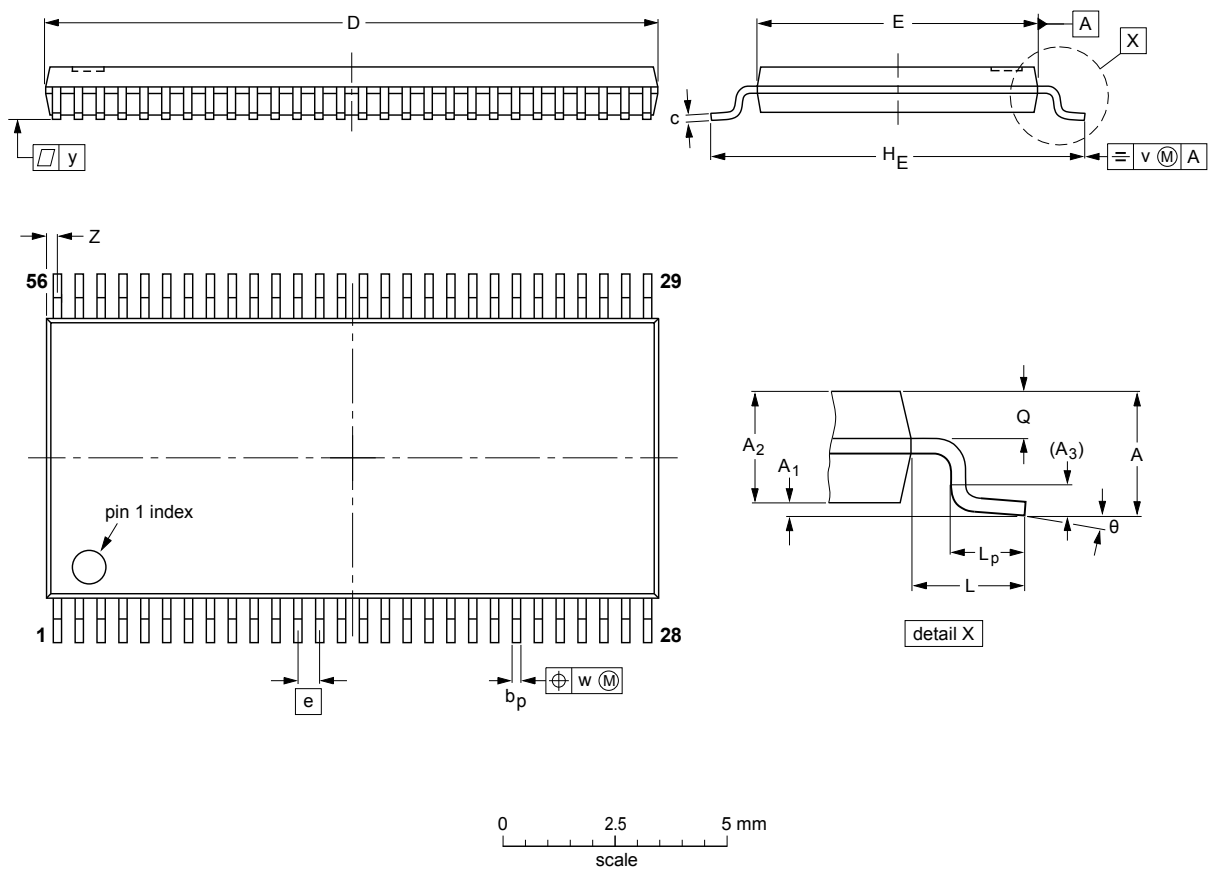
Figure 7. Test circuit for measuring switching times

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

TSSOP56: plastic thin shrink small outline package; 56 leads; body width 6.1 mm SOT364-1



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	14.1 13.9	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	0.5 0.1	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	JEITA			
SOT364-1		MO-153				99-12-27 03-02-19

Figure 8. Package outline SOT364-1 (TSSOP56)

## 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

## 13 Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74ALVT16827 v.4	20180124	Product data sheet	-	74ALVT16827 v.3
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 74ALVT16827DL (SOT371-1 / SSOP56) removed.</li></ul>			
74ALVT16827 v.3	20050602	Product data sheet	-	74ALVT16827 v.2
Modifications:	<ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors.</li><li><a href="#">Section 2</a>: modified 'JEDEC Std 17' into 'JESD78'.</li><li><a href="#">Section 10</a>: changed values in column 'min'</li></ul>			
74ALVT16827 v.2	19980213	Product specification	-	74ALVT16827 v.1
74ALVT16827 v.1	19960619	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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