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Team Nexperia

74ALVT16827

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

Rev. 03 — 2 June 2005 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 ($n\overline{OE1}$ and $n\overline{OE2}$) for maximum control flexibility.

2. Features

- 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
- ElectroStatic Discharge (ESD) protection:
  - MIL STD 883 Method 3015: exceeds 2000 V
  - Machine model: exceeds 200 V
- Bus hold data inputs eliminate need for external pull-up resistors to hold unused inputs

3. Quick reference data

Table 1: Quick reference data

GND = 0 V; T_{amb} = 25 °C.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
t_{PLH}	propagation delay nAx to nYx	C_L = 50 pF; V_{CC} = 2.5 V	1.0	2.0	2.9	ns
		C_L = 50 pF; V_{CC} = 3.3 V	0.7	1.5	2.2	ns
t_{PHL}	propagation delay nAx to nYx	C_L = 50 pF; V_{CC} = 2.5 V	1.0	2.0	3.0	ns
		C_L = 50 pF; V_{CC} = 3.3 V	0.8	1.6	2.3	ns
C_I	input capacitance on DIR, $\overline{OE}$	V_I = 0 V or V_{CC}	-	3	-	pF

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Table 1: Quick reference data *…continued*

GND = 0 V; T_{amb} = 25 °C.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C_O	output capacitance	$V_{I/O}$ = 0 V or V_{CC}	-	9	-	pF
I_{CC}	total supply current	outputs disabled; V_{CC} = 2.5 V	-	40	-	µA
		outputs disabled; V_{CC} = 3.3 V	-	70	-	µA

4. Ordering information

Table 2: Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74ALVT16827DL	–40 °C to +85 °C	SSOP56	plastic shrink small outline package; 56 leads; body width 7.5 mm	SOT371-1
74ALVT16827DGG	–40 °C to +85 °C	TSSOP56	plastic thin shrink small outline package; 56 leads; body width 6.1 mm	SOT364-1

5. Functional diagram

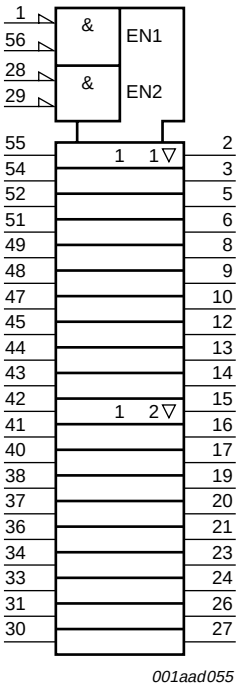


Fig 1. Logic symbol

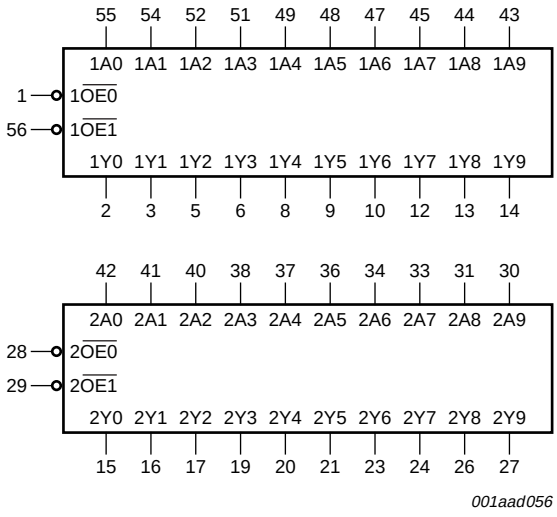


Fig 2. IEC logic symbol

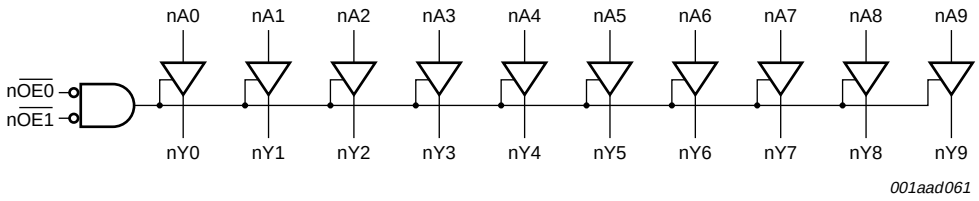


Fig 3. Logic diagram

6. Pinning information

6.1 Pinning

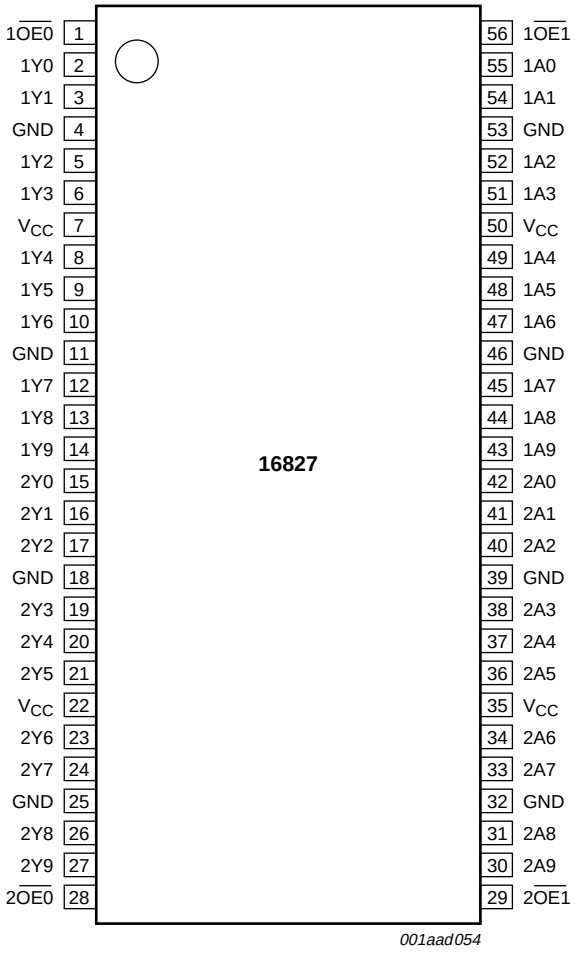


Fig 4. Pin configuration

6.2 Pin description

Table 3: Pin description

Symbol	Pin	Description
$1\overline{OE0}$	1	output enable input (active-LOW)
1Y0	2	data output
1Y1	3	data output
GND	4	ground (0 V)
1Y2	5	data output
1Y3	6	data output
V_{CC}	7	positive voltage supply
1Y4	8	data output
1Y5	9	data output
1Y6	10	data output
GND	11	ground (0 V)
1Y7	12	data output
1Y8	13	data output
1Y9	14	data output
2Y0	15	data output
2Y1	16	data output
2Y2	17	data output
GND	18	ground (0 V)
2Y3	19	data output
2Y4	20	data output
2Y5	21	data output
V_{CC}	22	positive voltage supply
2Y6	23	data output
2Y7	24	data output
GND	25	ground (0 V)
2Y8	26	data output
2Y9	27	data output
$2\overline{OE0}$	28	output enable input (active-LOW)
$2\overline{OE1}$	29	output enable input (active-LOW)
2A9	30	data input
2A8	31	data input
GND	32	ground (0 V)
2A7	33	data input
2A6	34	data input
V_{CC}	35	positive voltage supply
2A5	36	data input
2A4	37	data input
2A3	38	data input
GND	39	ground (0 V)

Table 3: Pin description *...continued*

Symbol	Pin	Description
2A2	40	data input
2A1	41	data input
2A0	42	data input
1A9	43	data input
1A8	44	data input
1A7	45	data input
GND	46	ground (0 V)
1A6	47	data input
1A5	48	data input
1A4	49	data input
V_{CC}	50	positive voltage supply
1A3	51	data input
1A2	52	data input
GND	53	ground (0 V)
1A1	54	data input
1A0	55	data input
$1\overline{OE1}$	56	output enable input (active-LOW)

7. Functional description

7.1 Function table

Table 4: Function table [1]

Input		Output	Operating mode
$n\overline{OEx}$	nAx	nYx	
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.

8. Limiting values

Table 5: Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). [1] *Voltages are referenced to GND (ground = 0 V).*

Symbol	Parameter	Conditions		Min	Max	Unit
V_{CC}	supply voltage			–0.5	+7.0	V
I_{IK}	input diode current	$V_I < 0$ V		–18	-	mA
V_I	input voltage		[2]	–1.2	+7.0	V
I_{OK}	output diode current	$V_O < 0$ V		–50	-	mA

Table 5: Limiting values *...continued*

In accordance with the Absolute Maximum Rating System (IEC 60134). [1] *Voltages are referenced to GND (ground = 0 V).*

Symbol	Parameter	Conditions		Min	Max	Unit
V_O	output voltage	output in OFF or HIGH-state	[2]	–0.5	+5.5	V
I_O	output current	output in LOW-state		-	128	mA
T_j	junction temperature			-	150	°C
T_{stg}	storage temperature			–65	+150	°C

[1] The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability. Exceed 150 °C.

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

9. Recommended operating conditions

Table 6: Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC} = 3.3 V ± 0.3 V						
V_{CC}	supply voltage		3.0	-	3.6	V
V_I	input voltage		0	-	5.5	V
V_{IH}	HIGH-level input voltage		2.0	-	-	V
V_{IL}	input voltage		-	-	0.8	V
I_{OH}	HIGH-level output current		-	-	–32	mA
I_{OL}	LOW-level output current		-	-	32	mA
		current duty cycle ≤ 50 %; f ≥ 1 kHz	-	-	64	mA
$\Delta t/\Delta v$	input transition rise or fall rate	outputs enabled	-	-	10	ns/V
T_{amb}	ambient temperature		–40	-	+85	°C
V_{CC} = 2.5 V ± 0.2 V						
V_{CC}	supply voltage		2.3	-	2.7	V
V_I	input voltage		0	-	5.5	V
V_{IH}	HIGH-level input voltage		1.7	-	-	V
V_{IL}	input voltage		-	-	0.7	V
I_{OH}	HIGH-level output current		-	-	–8	mA
I_{OL}	LOW-level output current		-	-	8	mA
		current duty cycle ≤ 50 %; f ≥ 1 kHz	-	-	24	mA
$\Delta t/\Delta v$	input transition rise or fall rate	outputs enabled	-	-	10	ns/V
T_{amb}	ambient temperature		–40	-	+85	°C

10. Static characteristics

Table 7: Static characteristics

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

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{CC} = 3.3 V ± 0.3 V [1]							
V_{IK}	input clamp voltage	V_{CC} = 3.0 V; I_{IK} = –18 mA		-	–0.85	–1.2	V
V_{OH}	HIGH-level output voltage	V_{CC} = 3.0 V to 3.6 V; I_{OH} = –100 µA		V_{CC} – 0.2	V_{CC}	-	V
		V_{CC} = 3.0 V; I_{OH} = –32 mA		2.0	2.3	-	V
V_{OL}	LOW-level output voltage	V_{CC} = 3.0 V					
		I_{OL} = 100 µA	[2]	-	0.07	0.2	V
		I_{OL} = 16 mA	[2]	-	0.25	0.4	V
		I_{OL} = 32 mA	[2]	-	0.3	0.5	V
		I_{OL} = 64 mA	[2]	-	0.4	0.55	V
I_{LI}	input leakage current						
	control pins	V_{CC} = 3.6 V; V_I = V_{CC} or GND		-	0.1	±1	µA
		V_{CC} = 0 V or 3.6 V; V_I = 5.5 V		-	0.1	10	µA
	I/O data pins	V_{CC} = 3.6 V; V_I = V_{CC}	[2]	-	0.5	1	µA
		V_{CC} = 3.6 V; V_I = 0 V	[2]	-	+0.1	–5	µA
I_{OFF}	off current	V_{CC} = 0 V; V_I or V_O = 0 V to 4.5 V		-	0.1	±100	µA
I_{HOLD}	bus hold current data inputs	V_{CC} = 3 V; V_I = 0.8 V	[3]	75	130	-	µA
		V_{CC} = 3 V; V_I = 2.0 V	[3]	–75	–140	-	µA
		V_{CC} = 0 V to 3.6 V; V_{CC} = 3.6 V	[3]	±500	-	-	µA
I_{EX}	current into an output in the HIGH-state when $V_O > V_{CC}$	V_O = 5.5 V; V_{CC} = 3.0 V		-	10	125	µA
I_{PU}, I_{PD}	power-up/down 3-state output current	$V_{CC} \leq$ 1.2 V; V_O = 0.5 V to V_{CC}; V_I = GND or V_{CC}; $n\overline{OEx}$ = don't care	[4]	-	1	±100	µA
I_{OZ}	3-state output current	V_{CC} = 3.6 V; V_I = V_{IL} or V_{IH}					
		output HIGH; V_O = 3.0 V		-	0.5	5	µA
		output LOW; V_O = 0.5 V		-	+0.5	–5	µA
I_{CC}	quiescent supply current	V_{CC} = 3.6 V; V_I = GND or V_{CC}; I_O = 0 A					
		outputs HIGH		-	0.07	0.1	mA
		outputs LOW		-	4.2	6	mA
		outputs disabled	[5]	-	0.07	0.1	mA
ΔI_{CC}	additional supply current per input pin	V_{CC} = 3 V to 3.6 V; one input at V_{CC} – 0.6 V, other inputs at V_{CC} or GND	[6]	-	0.04	0.4	mA
C_I	input capacitance	V_I = 0 V or V_{CC}		-	3	-	pF
C_O	output capacitance	$V_{I/O}$ = 0 V or V_{CC}		-	9	-	pF

Table 7: Static characteristics *…continued*

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

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{CC} = 2.5 V ± 0.2 V [7]							
V_{IK}	input clamp voltage	V_{CC} = 2.3 V; I_{IK} = –18 mA		-	–0.85	–1.2	V
V_{OH}	HIGH-level output voltage	V_{CC} = 2.3 V to 2.7 V; I_{OH} = –100 µA		V_{CC} – 0.2	V_{CC}	-	V
		V_{CC} = 2.3 V; I_{OH} = –8 mA		1.8	2.1	-	V
V_{OL}	LOW-level output voltage	V_{CC} = 2.3 V					
		I_{OL} = 100 µA		-	0.07	0.2	V
		I_{OL} = 24 mA		-	0.3	0.5	V
		I_{OL} = 100 µA		-	0.07	0.2	V
I_{LI}	input leakage current	V_{CC} = 2.3 V; I_{OL} = 24 mA		-	0.3	0.5	V
	control pins	V_{CC} = 2.7 V; V_I = V_{CC} or GND		-	0.1	±1	µA
	I/O data pins	V_{CC} = 0 V or 2.7 V; V_I = 5.5 V	[2]	-	0.1	10	µA
		V_{CC} = 2.7 V; V_I = V_{CC}	[2]	-	0.1	1	µA
		V_{CC} = 2.7 V; V_I = 0 V	[2]	-	+0.1	–5	µA
I_{OFF}	off current	V_{CC} = 0 V; V_I or V_O = 0 V to 4.5 V		-	0.1	±100	µA
I_{HOLD}	bus hold current data inputs	V_{CC} = 2.5 V; V_I = 0.8 V	[3]	-	115	-	µA
		V_{CC} = 2.5 V; V_I = 2.0 V	[3]	-	–10	-	µA
I_{EX}	current into an output in the HIGH-state when $V_O > V_{CC}$	V_O = 5.5 V; V_{CC} = 2.3 V		-	10	125	µA
I_{PU}, I_{PD}	power-up/down 3-state output current	$V_{CC} \leq$ 1.2 V; V_O = 0.5 V to V_{CC}; V_I = GND or V_{CC}; $n\overline{OE}x$ = don't care	[4]	-	1	100	µA
I_{OZ}	3-state output current	V_{CC} = 2.7 V; V_O = 2.3 V; V_I = V_{IL} or V_{IH}					
		output HIGH; V_O = 2.3 V		-	0.5	5	µA
		output LOW; V_O = 0.5 V		-	+0.5	–5	µA
I_{CC}	quiescent supply current	V_{CC} = 2.7 V; V_I = GND or V_{CC}; I_O = 0 A					
		outputs HIGH		-	0.04	0.1	mA
		outputs LOW		-	3.6	5.0	mA
		outputs disabled	[5]	-	0.04	0.1	mA
ΔI_{CC}	additional supply current per input pin	V_{CC} = 2.3 V to 2.7 V; one input at V_{CC} – 0.6 V, other inputs at V_{CC} or GND	[6]	-	0.04	0.4	mA

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

[2] Unused pins at V_{CC} or GND.

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

[4] This parameter is valid for any V_{CC} between 0 V and 1.2 V with a transition time of up to 10 ms. From V_{CC} = 1.2 V to V_{CC} = 3.3 V ± 0.3 V a transition time of 100 µs is permitted. This parameter is valid for T_{amb} = 25 °C only.

[5] I_{CC} is measured with outputs pulled up to V_{CC} or pulled down to ground.

[6] This is the increase in supply current for each input at the specified voltage level other than V_{CC} or GND.

[7] All typical values are at V_{CC} = 2.5 V and T_{amb} = 25 °C.

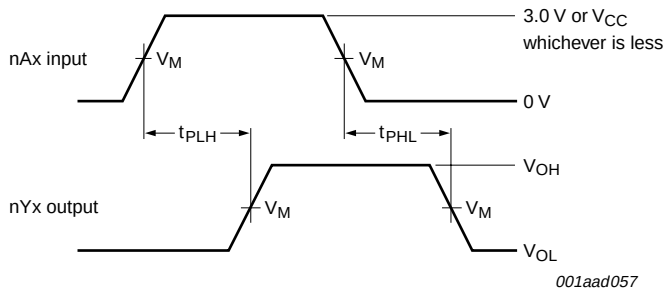
11. Dynamic characteristics

Table 8: Dynamic characteristics

GND = 0 V; $t_r = t_f$ = 2.5 ns; C_L = 50 pF; R_L = 500 Ω; T_{amb} = -40 °C to +85 °C; for test circuit see Figure 7.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC} = 3.3 V ± 0.3 V						
t_{PLH}	propagation delay nAx to nYx	see Figure 5	0.7	1.5	2.2	ns
t_{PHL}	propagation delay nAx to nYx	see Figure 5	0.8	1.6	2.3	ns
t_{PZH}	output enable time to HIGH-level	see Figure 6	1.6	2.6	3.8	ns
t_{PZL}	output enable time to LOW-level	see Figure 6	1.4	2.3	3.2	ns
t_{PHZ}	output disable time from HIGH-level	see Figure 6	2.3	3.2	4.8	ns
t_{PLZ}	output disable time from LOW-level	see Figure 6	1.5	2.5	3.8	ns
V_{CC} = 2.5 V ± 0.2 V						
t_{PLH}	propagation delay nAx to nYx	see Figure 5	1.0	2.0	2.9	ns
t_{PHL}	propagation delay nAx to nYx	see Figure 5	1.0	2.0	3.0	ns
t_{PZH}	output enable time to HIGH-level	see Figure 6	2.0	3.2	5.5	ns
t_{PZL}	output enable time to LOW-level	see Figure 6	1.7	2.9	4.3	ns
t_{PHZ}	output disable time from HIGH-level	see Figure 6	1.8	2.8	5.1	ns
t_{PLZ}	output disable time from LOW-level	see Figure 6	1.4	2.3	3.9	ns

12. AC waveforms



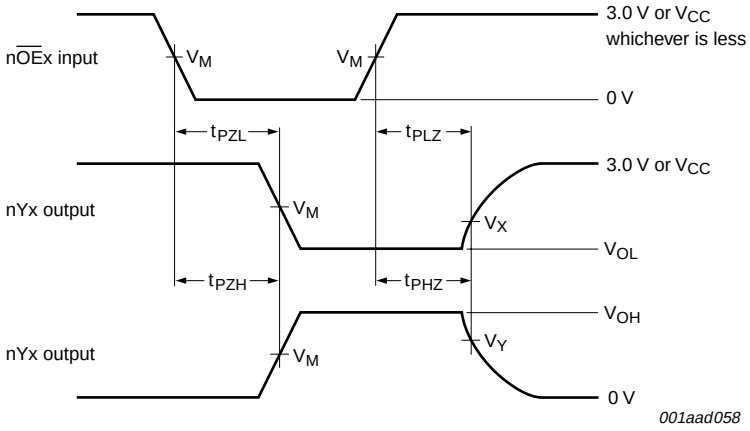
V_M = 1.5 V for $V_{CC} \geq 3.0$ V; $V_M = V_{CC}/2$ for $V_{CC} \geq 2.7$ V.

$V_X = V_{OL} + 0.3$ V for $V_{CC} \geq 3.0$ V; $V_X = V_{OL} + 0.15$ V for $V_{CC} \leq 2.7$ V.

$V_Y = V_{OH} - 0.3$ V for $V_{CC} \geq 3.0$ V; $V_Y = V_{OH} - 0.15$ V for $V_{CC} \leq 2.7$ V.

V_{OL} and V_{OH} are the typical output voltage drop that occur with the output load.

Fig 5. The input (nAx) to output (nYx) propagation delays



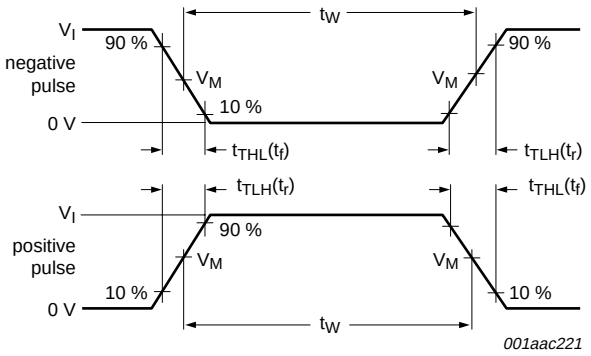
V_M = 1.5 V for $V_{CC} \geq 3.0$ V; $V_M = V_{CC}/2$ for $V_{CC} \geq 2.7$ V.

$V_X = V_{OL} + 0.3$ V for $V_{CC} \geq 3.0$ V; $V_X = V_{OL} + 0.15$ V for $V_{CC} \leq 2.7$ V.

$V_Y = V_{OH} - 0.3$ V for $V_{CC} \geq 3.0$ V; $V_Y = V_{OH} - 0.15$ V for $V_{CC} \leq 2.7$ V.

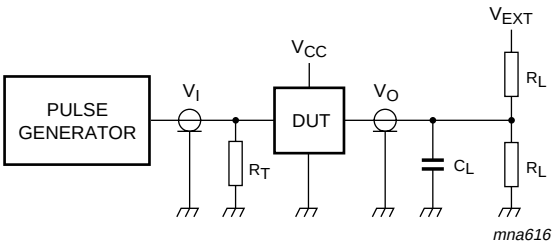
V_{OL} and V_{OH} are the typical output voltage drop that occur with the output load.

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



V_M = 1.5 V.

a. Input pulse definition



Test data is given in Table 9.

Definitions test circuit:

R_L = Load resistor.

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.

b. Test circuit

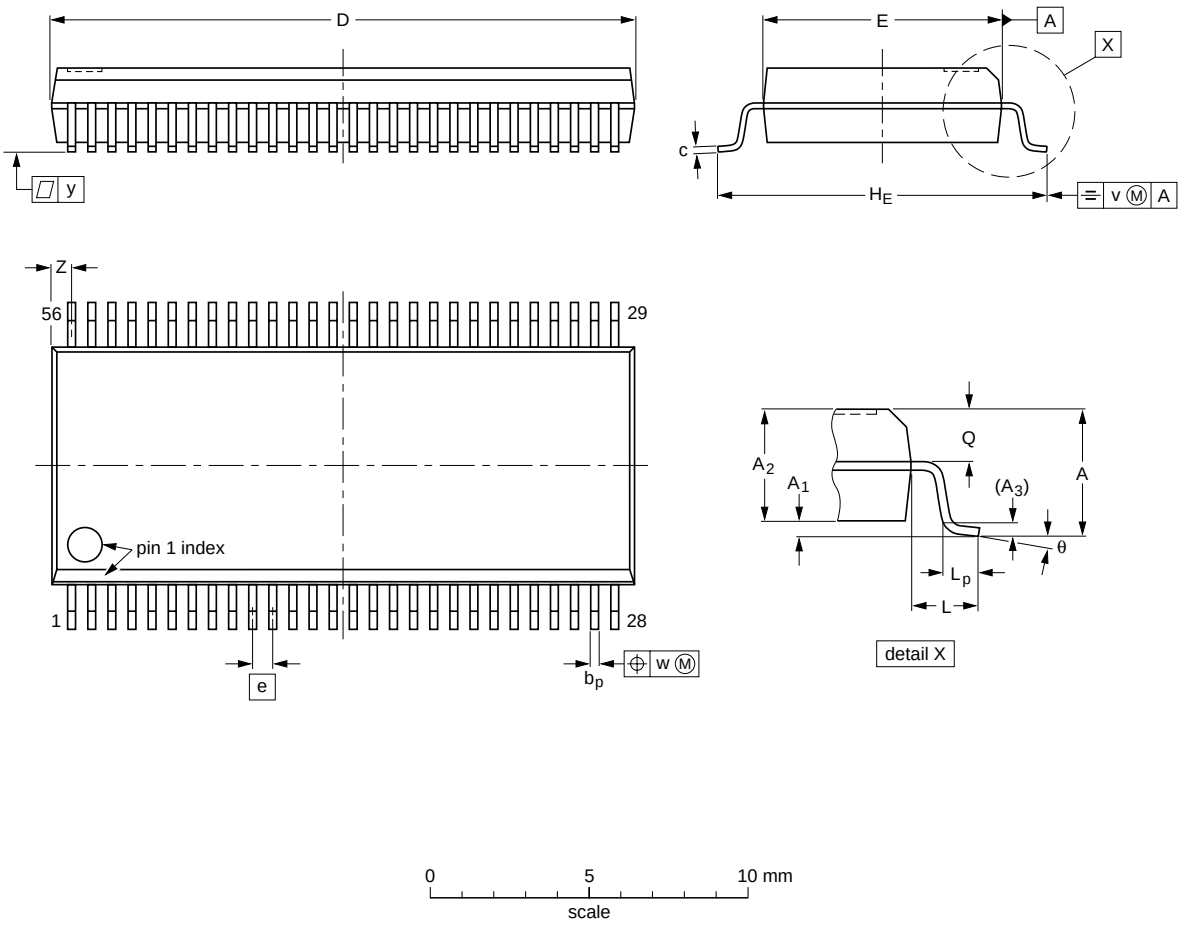
Fig 7. Load circuitry for switching times

Table 9: Test data

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

13. Package outline

SSOP56: plastic shrink small outline package; 56 leads; body width 7.5 mm **SOT371-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (1)	e	H_E	L	L_p	Q	v	w	y	Z (1)	θ
mm	2.8	0.4 0.2	2.35 2.20	0.25	0.3 0.2	0.22 0.13	18.55 18.30	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^o 0^o

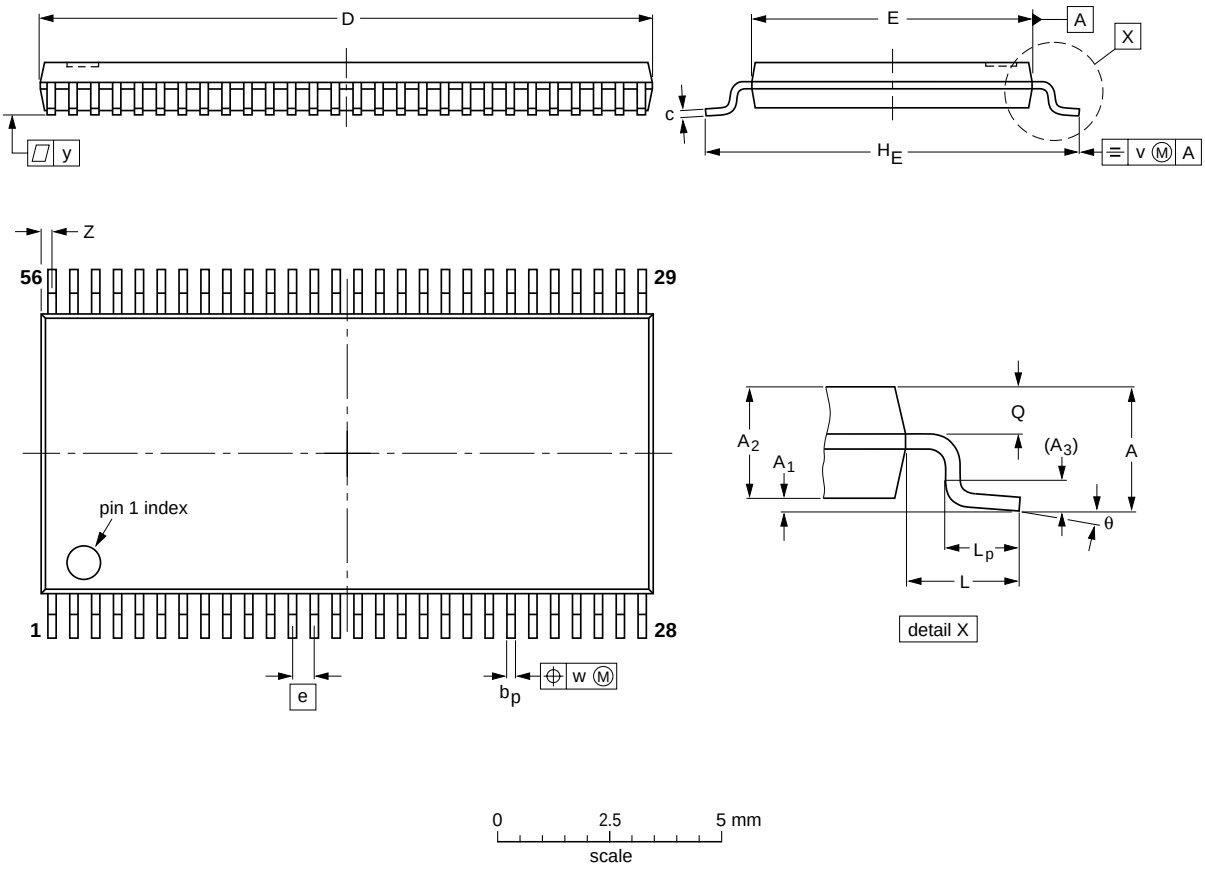
Note

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

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT371-1		MO-118				~~99-12-27~~ 03-02-18

Fig 8. Package outline SOT371-1 (SSOP56)

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_1	A_2	A_3	b_p	c	D(1)	E(2)	e	H_E	L	L_p	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^o 0^o

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

Fig 9. Package outline SOT364-1 (TSSOP56)

14. Revision history

Table 10: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
74ALVT16827_3	20050602	Product data sheet	-	9397 750 15122	74ALVT16827_2
Modifications:	• The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors. • Section 2 “Features”: modified ‘JEDEC Std 17’ into ‘JESD78’. • Section 11 “Dynamic characteristics”: changed values in column ‘min’				

15. Data sheet status

Level	Data sheet status [1]	Product status [2] [3]	Definition
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.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
III	Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN).

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

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL http://www.semiconductors.philips.com.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

16. Definitions

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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20. Contents

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