74LVT162240A

3.3 V 16-bit inverting buffer/driver with 30 Ω termination resistors; 3-state

Rev. 4 — 4 June 2018 Product data sheet

1 General description

The 74LVT162240A 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 enable pins (1$\overline{OE}$, 2$\overline{OE}$, 3$\overline{OE}$, 4$\overline{OE}$), each controlling four of the 3-state outputs.

The 74LVT162240A is designed with 30 Ω series resistance in both the pull-up and pull-down output structures. This design reduces line noise in applications such as memory address drivers, clock drivers, and bus receivers/transmitters.

2 Features and benefits

- 16-bit bus interface
- 3-state buffers
- Output capability: +12 mA/–12 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
- Outputs include series resistance of 30 Ω making external termination resistors unnecessary
- 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:
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V

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3 Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LVT162240ADGG	-40 °C to +85 °C	TSSOP48	plastic thin shrink small outline package; 48 leads; body width 6.1 mm	SOT362-1

4 Functional diagram

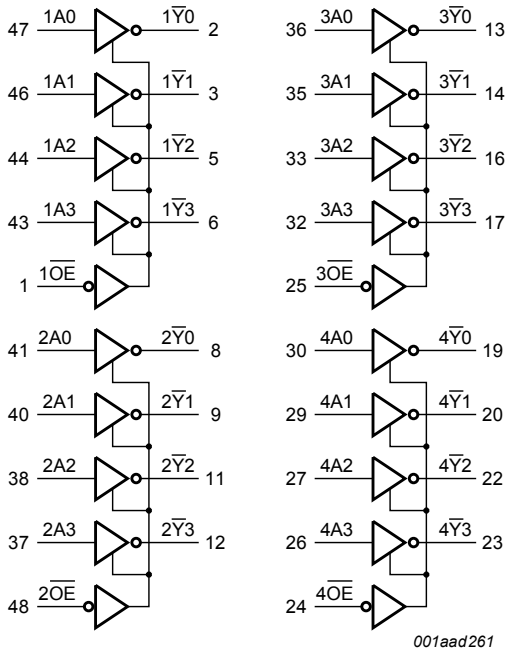


Figure 1. Logic symbol

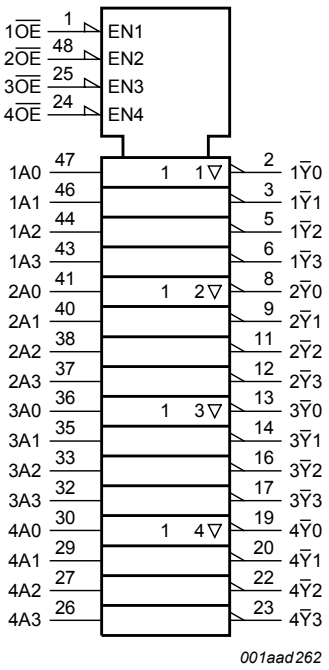


Figure 2. IEC logic symbol

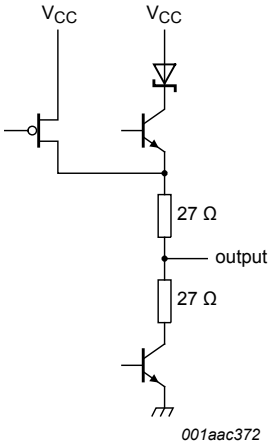


Figure 3. Schematic of one output

5 Pinning information

5.1 Pinning

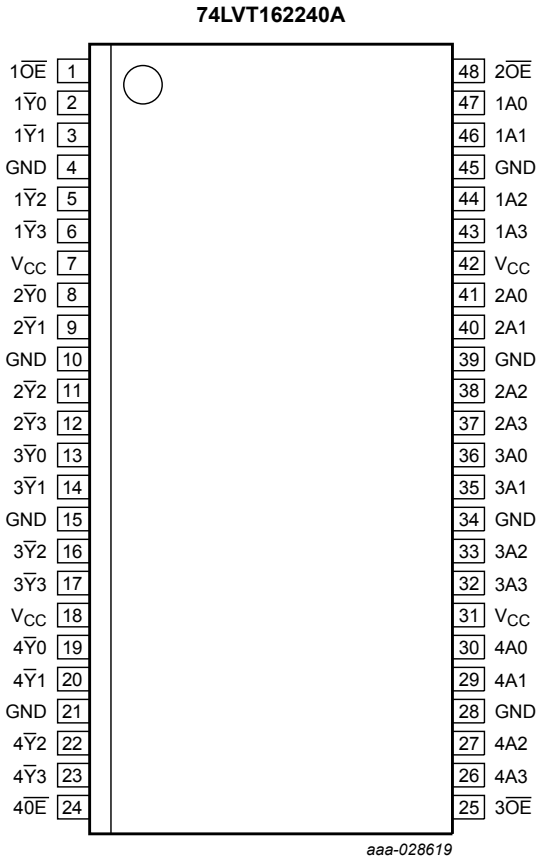


Figure 4. Pin configuration SOT362-1 (TSSOP48)

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
$1\overline{Y}0$, $1\overline{Y}1$, $1\overline{Y}2$, $1\overline{Y}3$	2, 3, 5, 6	data outputs
$2\overline{Y}0$, $2\overline{Y}1$, $2\overline{Y}2$, $2\overline{Y}3$	8, 9, 11, 12	data outputs
$3\overline{Y}0$, $3\overline{Y}1$, $3\overline{Y}2$, $3\overline{Y}3$	13, 14, 16, 17	data outputs
$4\overline{Y}0$, $4\overline{Y}1$, $4\overline{Y}2$, $4\overline{Y}3$	19, 20, 22, 23	data outputs
GND	4, 10, 15, 21, 28, 34, 39, 45	ground (0 V)
V_{CC}	7, 18, 31, 42	supply voltage

6 Functional description

Table 3. Function table [1]

Input		Output
$n\overline{OE}$	**nAn**	**$n\overline{Y}n$**
L	L	H
L	H	L
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	[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. Operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage		2.7	-	3.6	V
V_I	input voltage		0	-	5.5	V
I_{OH}	HIGH-level output current		-	-	-12	mA
I_{OL}	LOW-level output current		-	-	12	mA
T_{amb}	ambient temperature	in free air	-40	-	+85	°C
$\Delta t/\Delta V$	input transition rise and fall rate	outputs enabled	-	-	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[1]	Max	Unit
V_{IK}	input clamping voltage	V_{CC} = 2.7 V; I_{IK} = -18 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 V; I_{OH} = -12 mA	2.0	-	-	V
V_{OL}	LOW-level output voltage	V_{CC} = 3.0 V; I_{OL} = 12 mA	-	-	0.8	V

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
I_I	input leakage current	all input pins				
		V_{CC} = 0 V or 3.6 V; V_I = 5.5 V	-	0.4	10	µA
		control pins				
		V_{CC} = 3.6 V; V_I = V_{CC} or GND	-	±0.1	±1	µA
		data pins				
		V_{CC} = 3.6 V; V_I = V_{CC} [2]	-	0.1	1	µA
		V_{CC} = 3.6 V; V_I = 0 V [2]	-	-0.4	-5	µA
I_{OFF}	power-off leakage current	V_{CC} = 0 V; V_I or V_O = 0 V to 4.5 V	-	0.1	±100	µA
I_{BHL}	bus hold LOW current	nAn input; V_{CC} = 3 V; V_I = 0.8 V	75	135	-	µA
I_{BHH}	bus hold HIGH current	nAn input; V_{CC} = 3 V; V_I = 2.0 V	-75	-135	-	µA
I_{BHLO}	bus hold LOW overdrive current	nAn input; V_{CC} = 3.6 V; V_I = 0 V to 3.6 V [3]	500	-	-	µA
I_{BHHO}	bus hold HIGH overdrive current	nAn input; V_{CC} = 3.6 V; V_I = 0 V to 3.6 V [3]	-	-	-500	µA
I_{EX}	external current	output in HIGH-state when $V_O > V_{CC}$; V_O = 5.5 V; V_{CC} = 3.0 V	-	50	125	µA
$I_{O(pu/pd)}$	power-up/power-down output current	$V_{CC} \leq$ 1.2 V; V_O = 0.5 V to V_{CC}; V_I = GND or V_{CC}; $n\overline{OE}$ = don't care [4]	-	1	±100	µA
I_{OZ}	OFF-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}	supply current	V_{CC} = 3.6 V; V_I = GND or V_{CC}; I_O = 0 A				
		outputs HIGH	-	0.07	0.12	mA
		outputs LOW	-	4.0	6	mA
		outputs disabled [5]	-	0.07	0.12	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 and other inputs at V_{CC} or GND [6]	-	0.1	0.2	mA
C_I	input capacitance	$n\overline{OE}$; V_I = 0 V or 3 V	-	3	-	pF
C_O	output capacitance	V_O = 0 V or 3.0 V	-	9	-	pF

[1] All typical values are at V_{CC} = 3.3 V (unless stated otherwise) 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] Measured with outputs pulled up to V_{CC} or GND.
[6] This is the increase in supply current for each input at the specified voltage level other than V_{CC} or GND.

10 Dynamic characteristics

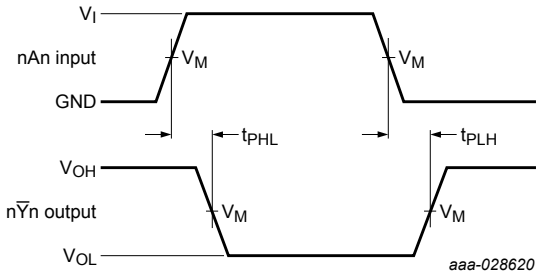
Table 7. Dynamic characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for test circuit see Figure 7.

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
t_{PLH}	LOW to HIGH propagation delay	nAn to n$\overline{Y}$n; see Figure 5				
		V_{CC} = 2.7 V	-	-	5.0	ns
		V_{CC} = 3.3 V ± 0.3 V	0.5	2.6	4.2	ns
t_{PHL}	HIGH to LOW propagation delay	nAn to n$\overline{Y}$n; see Figure 5				
		V_{CC} = 2.7 V	-	-	5.0	ns
		V_{CC} = 3.3 V ± 0.3 V	0.5	2.6	4.2	ns
t_{PZH}	OFF-state to HIGH propagation delay	n$\overline{OE}$ to n$\overline{Y}$n; see Figure 6				
		V_{CC} = 2.7 V	-	-	6.5	ns
		V_{CC} = 3.3 V ± 0.3 V	1.0	3.3	5.5	ns
t_{PZL}	OFF-state to LOW propagation delay	n$\overline{OE}$ to n$\overline{Y}$n; see Figure 6				
		V_{CC} = 2.7 V	-	-	5.5	ns
		V_{CC} = 3.3 V ± 0.3 V	1.0	3.0	5.0	ns
t_{PHZ}	HIGH to OFF-state propagation delay	n$\overline{OE}$ to n$\overline{Y}$n; see Figure 6				
		V_{CC} = 2.7 V	-	-	5.5	ns
		V_{CC} = 3.3 V ± 0.3 V	1.0	3.5	5.0	ns
t_{PLZ}	LOW to OFF-state propagation delay	n$\overline{OE}$ to n$\overline{Y}$n; see Figure 6				
		V_{CC} = 2.7 V	-	-	4.5	ns
		V_{CC} = 3.3 V ± 0.3 V	1.0	3.2	4.5	ns

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

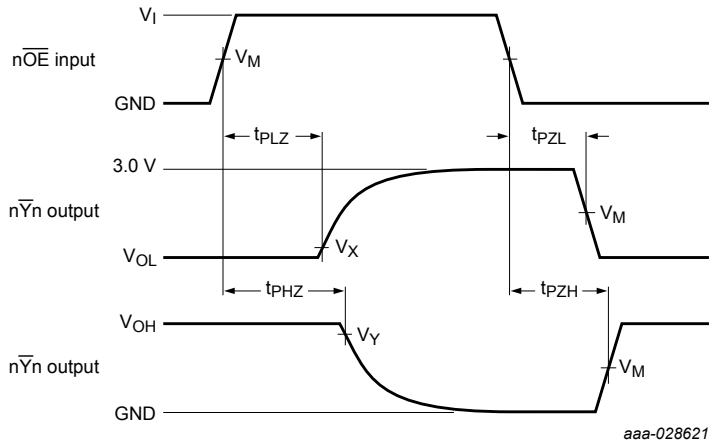
10.1 Waveforms and test circuit



Measurement points are given in Table 8.

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

Figure 5. Input (nAn) to output (nȲn) propagation delay



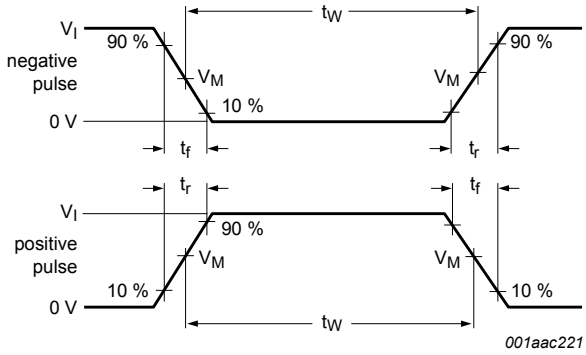
Measurement points are given in Table 8.

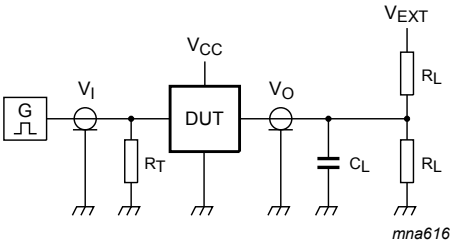
V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

Figure 6. Enable and disable times of 3-state outputs

Table 8. Measurement points

Input	Output		
V_M	V_M	V_X	V_Y
1.5 V	1.5 V	V_{OL} + 0.3 V	V_{OH} - 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.

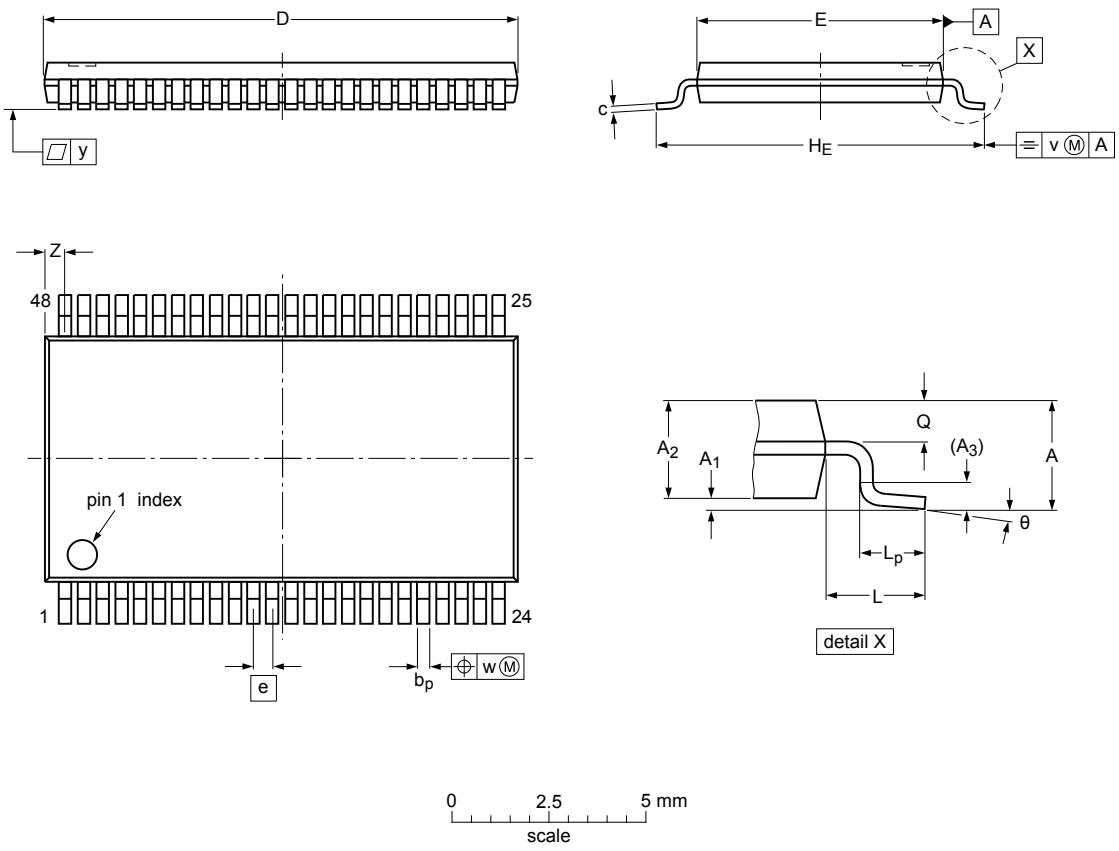
Figure 7. Test circuit for measuring switching times

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}
2.7 V	≤ 10 MHz	500 ns	≤ 2.5 ns	50 pF	500 Ω	GND	6 V	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_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	max		0.15	1.05		0.28	0.2	12.6	6.2		8.3		0.8	0.50				0.8	8°
	nom	1.2			0.25					0.5		1			0.25	0.08	0.1		
	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 TSSOP48 (SOT362-1)

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
74LVT162240A v.4	20180604	Product data sheet	-	74LVT162240A v.3
Modifications:	• The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. • Legal texts have been adapted to the new company name where appropriate. • Type number 74LVT162240ADL (SSOP48 / SOT370-1) removed.			
74LVT162240A v.3	20030221	Product data sheet	ECN 853-1777 29438	74LVT162240A v.2
Modifications:	• Table 1 corrected: removed ‘North America’ column. • Figure 2 modified to correct pin names			
74LVT162240A v.2	19980219	Product specification	ECN 853-1777 18990	74LVT162240A v.1
74LVT162240A v.1	19950822	Product specification	-	-

14 Legal information

14.1 Data sheet status

Document status[1][2]	Product status[3]	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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