

# 74LVC16241A

16-bit buffer/line driver with 5 V tolerant inputs/outputs;  
3-state

Rev. 6 — 4 August 2023

Product data sheet

## 1. General description

The 74LVC16241A is a 16-bit non-inverting buffer/line driver with 3-state outputs. The 3-state outputs are controlled by the output enable inputs (1OE, 2OE, 3OE and 4OE). Schmitt trigger action at all inputs makes the circuit highly tolerant of slower input rise and fall times. The device can be used as four 4-bit buffers, two 8-bit buffers or one 16-bit buffer.

Inputs can be driven from either 3.3 V or 5 V devices. When disabled, up to 5.5 V can be applied to the outputs. These features allow the use of these devices in mixed 3.3 V and 5 V applications.

## 2. Features and benefits

- 5 V tolerant inputs and outputs for interfacing with 5 V logic
- 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 power and ground pins for minimum noise and ground bounce
- Direct interface with TTL levels
- High-impedance outputs when  $V_{CC} = 0$  V
- Complies with JEDEC standard:
  - JESD8-7A (1.65 V to 1.95 V)
  - JESD8-5A (2.3 V to 2.7 V)
  - JESD8-C/JESD36 (2.7 V to 3.6 V)
- ESD protection:
  - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
  - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Specified from -40 °C to +85 °C and -40 °C to +125 °C.

## 3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
<a href="#">74LVC16241ADGG</a>	-40 °C to +125 °C	TSSOP48	plastic thin shrink small outline package; 48 leads; body width 6.1 mm	<a href="#">SOT362-1</a>

4. Functional diagram

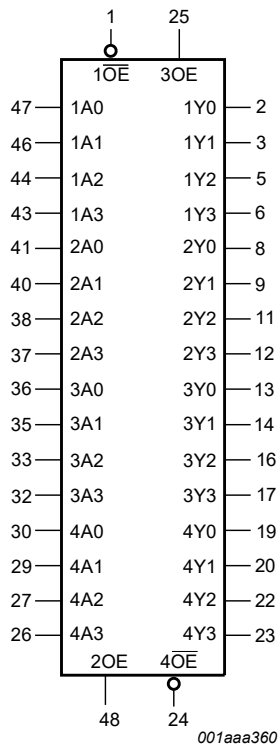


Fig. 1. Logic symbol

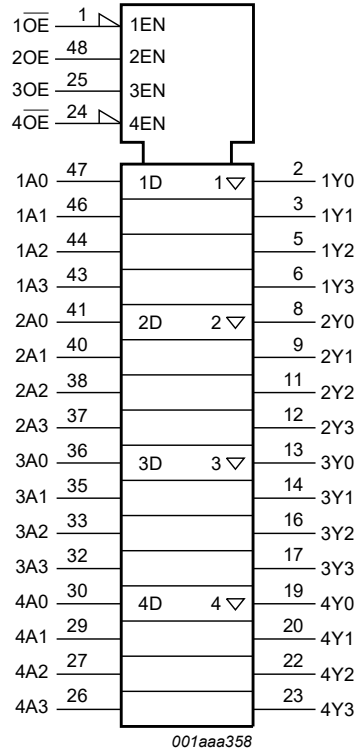


Fig. 2. IEC logic symbol

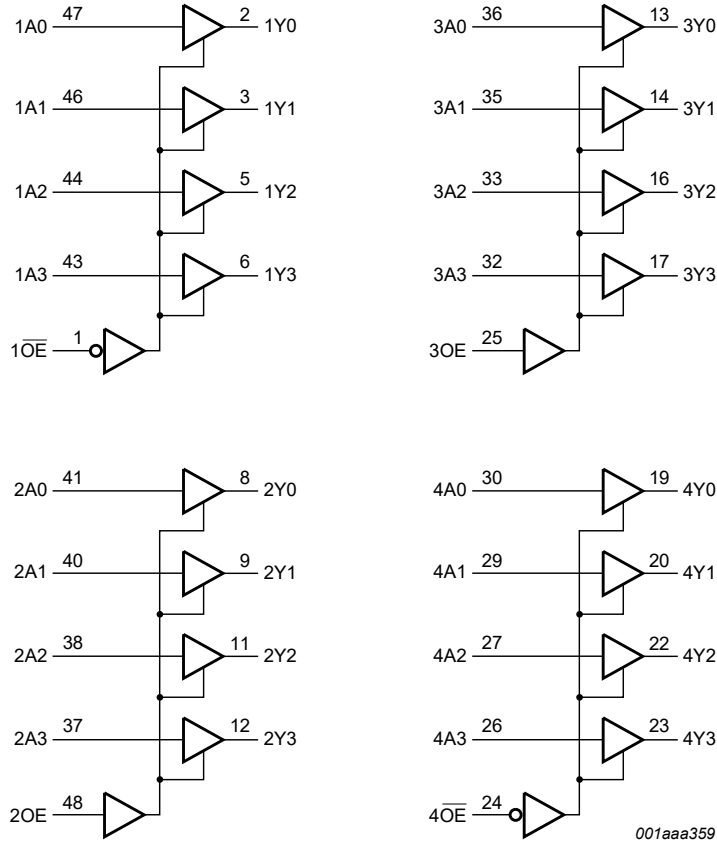


Fig. 3. Logic diagram

## 5. Pinning information

### 5.1. Pinning

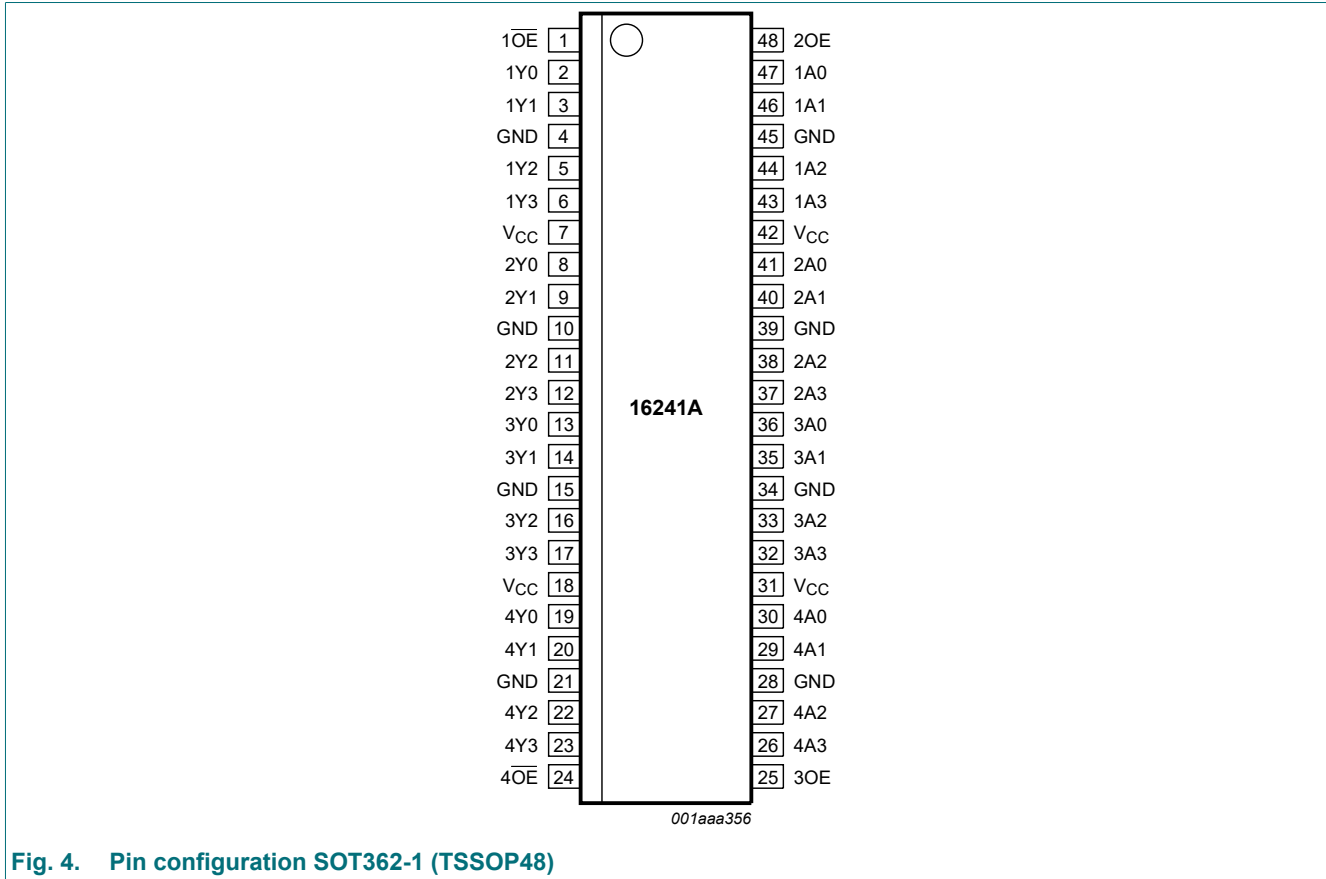


Fig. 4. Pin configuration SOT362-1 (TSSOP48)

### 5.2. Pin description

Table 2. Pin description

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

## 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
nAn	nOE	nOE	nYn
H	L	-	H
	-	H	H
L	L	-	L
	-	H	L
X	H	-	Z
	-	L	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	+6.5	V
$I_{IK}$	input clamping current	$V_I < 0$ V	-50	-	mA
$V_I$	input voltage		[1] -0.5	+6.5	V
$I_{OK}$	output clamping current	$V_O > V_{CC}$ or $V_O < 0$ V	-	±50	mA
$V_O$	output voltage	HIGH or LOW state	[2] -0.5	$V_{CC} + 0.5$	V
		3-state	[2] -0.5	+6.5	V
$I_O$	output current	$V_O = 0$ V to $V_{CC}$	-	±50	mA
$I_{CC}$	supply current		-	100	mA
$I_{GND}$	ground current		-100	-	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_{tot}$	total power dissipation	$T_{amb} = -40$ °C to +125 °C	[3] -	500	mW

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

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

[3] For SOT362-1 (TSSOP48) packages:  $P_{tot}$  derates linearly with 12.2 mW/K above 109 °C.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC}$	supply voltage		1.65	-	3.6	V
		functional	1.2	-	-	V
$V_I$	input voltage		0	-	5.5	V
$V_O$	output voltage	HIGH or LOW state	0	-	$V_{CC}$	V
		3-state	0	-	5.5	V
$T_{amb}$	ambient temperature	in free air	-40	-	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 1.65$ V to 2.7 V	0	-	20	ns/V
		$V_{CC} = 2.7$ V to 3.6 V	0	-	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	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 1.2 V	1.08	-	-	1.08	-	V
		V <sub>CC</sub> = 1.65 V to 1.95 V	0.65V <sub>CC</sub>	-	-	0.65V <sub>CC</sub>	-	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.7	-	-	1.7	-	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	2.0	-	-	2.0	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 1.2 V	-	-	0.12	-	0.12	V
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	-	0.35V <sub>CC</sub>	-	0.35V <sub>CC</sub>	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	-	0.7	-	0.7	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	-	-	0.8	-	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 µA; V <sub>CC</sub> = 1.65 V to 3.6 V	V <sub>CC</sub> - 0.2	-	-	V <sub>CC</sub> - 0.3	-	V
		I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 1.65 V	1.2	-	-	1.05	-	V
		I <sub>O</sub> = -8 mA; V <sub>CC</sub> = 2.3 V	1.8	-	-	1.65	-	V
		I <sub>O</sub> = -12 mA; V <sub>CC</sub> = 2.7 V	2.2	-	-	2.05	-	V
		I <sub>O</sub> = -18 mA; V <sub>CC</sub> = 3.0 V	2.4	-	-	2.25	-	V
		I <sub>O</sub> = -24 mA; V <sub>CC</sub> = 3.0 V	2.2	-	-	2.0	-	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 µA; V <sub>CC</sub> = 1.65 V to 3.6 V	-	-	0.2	-	0.3	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V	-	-	0.45	-	0.65	V
		I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V	-	-	0.6	-	0.8	V
		I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V	-	-	0.4	-	0.6	V
		I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V	-	-	0.55	-	0.8	V
I <sub>I</sub>	input leakage current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = 5.5 V or GND	-	±0.1	±5	-	±20	µA
I <sub>OZ</sub>	OFF-state output current	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 3.6 V; V <sub>O</sub> = 5.5 V or GND	-	±0.1	±5	-	±20	µA
I <sub>OFF</sub>	power-off leakage current	V <sub>CC</sub> = 0 V; V <sub>I</sub> or V <sub>O</sub> = 5.5 V	-	±0.1	±10	-	±20	µA
I <sub>CC</sub>	supply current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A	-	0.1	20	-	80	µA
ΔI <sub>CC</sub>	additional supply current	per input pin; V <sub>CC</sub> = 2.7 V to 3.6 V; V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A	-	5	500	-	5000	µA
C <sub>I</sub>	input capacitance	V <sub>CC</sub> = 0 V to 3.6 V; V <sub>I</sub> = GND to V <sub>CC</sub>	-	5.0	-	-	-	pF

[1] All typical values are measured at V<sub>CC</sub> = 3.3 V (unless stated otherwise) and 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 Fig. 8.

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit		
			Min	Typ [1]	Max	Min	Max			
t <sub>pd</sub>	propagation delay	nAn to nYn; see Fig. 5 [2]								
		V <sub>CC</sub> = 1.2 V	-	13	-	-	-	ns		
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.7	4.8	10.1	1.7	11.7	ns		
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.5	2.6	5.3	1.5	6.1	ns		
		V <sub>CC</sub> = 2.7 V	1.0	2.6	5.0	1.0	6.5	ns		
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	2.2	4.4	1.0	5.5	ns		
t <sub>en</sub>	enable time	nOE to nYn; see Fig. 6 [2]								
		V <sub>CC</sub> = 1.2 V	-	17	-	-	-	ns		
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.0	5.2	12.5	1.0	13.2	ns		
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	3.0	6.9	1.0	7.3	ns		
		V <sub>CC</sub> = 2.7 V	1.0	3.2	6.0	1.0	7.5	ns		
				V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	2.4	5.5	1.0	7.0	ns
		nOE to nYn; see Fig. 7 [2]								
		V <sub>CC</sub> = 1.2 V	-	19	-	-	-	ns		
		V <sub>CC</sub> = 1.65 V to 1.95 V	2.5	6.9	14.2	2.5	15.0	ns		
		V <sub>CC</sub> = 2.3 V to 2.7 V	2.1	3.9	7.5	2.1	8.3	ns		
		V <sub>CC</sub> = 2.7 V	1.5	3.3	6.0	1.5	7.5	ns		
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.5	3.1	5.5	1.5	7.0	ns		
t <sub>dis</sub>	disable time	nOE to nYn; see Fig. 6 [2]								
		V <sub>CC</sub> = 1.2 V	-	9.0	-	-	-	ns		
		V <sub>CC</sub> = 1.65 V to 1.95 V	2.4	4.3	8.3	2.4	9.2	ns		
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	2.4	4.7	1.0	5.2	ns		
		V <sub>CC</sub> = 2.7 V	1.5	3.2	5.5	1.5	7.0	ns		
				V <sub>CC</sub> = 3.0 V to 3.6 V	1.5	3.0	5.0	1.5	6.5	ns
		nOE to nYn; see Fig. 7 [2]								
		V <sub>CC</sub> = 1.2 V	-	8.0	-	-	-	ns		
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.5	3.5	8.4	1.5	9.6	ns		
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.5	1.9	4.8	0.5	5.5	ns		
		V <sub>CC</sub> = 2.7 V	1.5	3.5	5.5	1.5	7.0	ns		
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	2.6	5.0	1.0	6.5	ns		
C <sub>PD</sub>	power dissipation capacitance	per input; V <sub>I</sub> = GND to V <sub>CC</sub> [3]								
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	8.4	-	-	-	pF		
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	11.9	-	-	-	pF		
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	15.0	-	-	-	pF		

[1] Typical values are measured at T<sub>amb</sub> = 25 °C and V<sub>CC</sub> = 1.2 V, 1.8 V, 2.5 V, 2.7 V, and 3.3 V respectively.

[2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>; t<sub>en</sub> is the same as t<sub>PZL</sub> and t<sub>PZH</sub>; t<sub>dis</sub> is the same as t<sub>PJZ</sub> and t<sub>PJH</sub>.

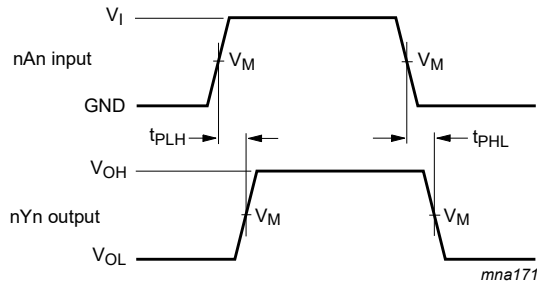
[3] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW). P<sub>D</sub> = C<sub>PD</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>i</sub> × N + Σ(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) where:

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; Σ(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of the outputs

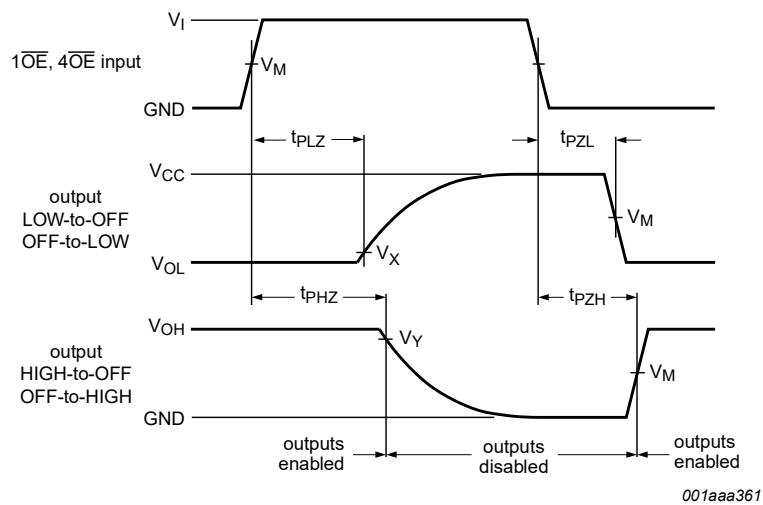
10.1. Waveforms and test circuit



Measurements points are given in [Table 8](#).

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

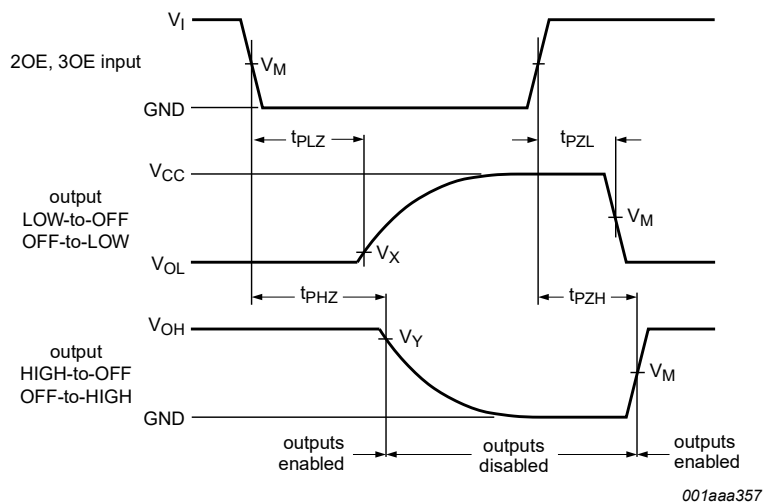
Fig. 5. Input nAn to output nYn propagation delays



Measurements points are given in [Table 8](#).

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

Fig. 6. 3-state enable and disable times for inputs  $1\overline{OE}$  and  $4\overline{OE}$



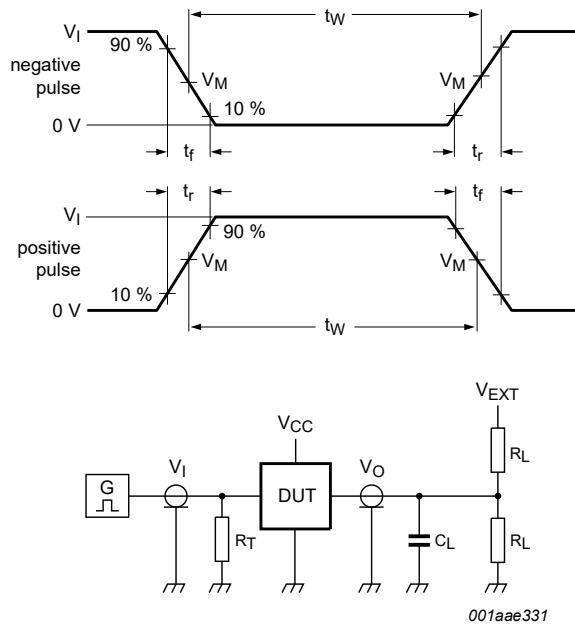
Measurements points are given in [Table 8](#).

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

Fig. 7. 3-state enable and disable times for inputs 2OE and 3OE

Table 8. Measurement points

Supply voltage	Input	Output		
$V_{CC}$	$V_M$	$V_M$	$V_X$	$V_Y$
1.2 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
1.65 V to 1.95 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
2.3 V to 2.7 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
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	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.

Fig. 8. Test circuit for measuring switching times

Table 9. Test data

Supply voltage	Input		Load		$V_{EXT}$		
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PLH}, t_{PHL}$	$t_{PLZ}, t_{PZL}$	$t_{PHZ}, t_{PZH}$
1.2 V	$V_{CC}$	$\leq 2 \text{ ns}$	30 pF	1 k $\Omega$	open	$2 \times V_{CC}$	GND
1.65 V to 1.95 V	$V_{CC}$	$\leq 2 \text{ ns}$	30 pF	1 k $\Omega$	open	$2 \times V_{CC}$	GND
2.3 V to 2.7 V	$V_{CC}$	$\leq 2 \text{ ns}$	30 pF	500 $\Omega$	open	$2 \times V_{CC}$	GND
2.7 V	2.7 V	$\leq 2.5 \text{ ns}$	50 pF	500 $\Omega$	open	$2 \times V_{CC}$	GND
3.0 V to 3.6 V	2.7 V	$\leq 2.5 \text{ ns}$	50 pF	500 $\Omega$	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

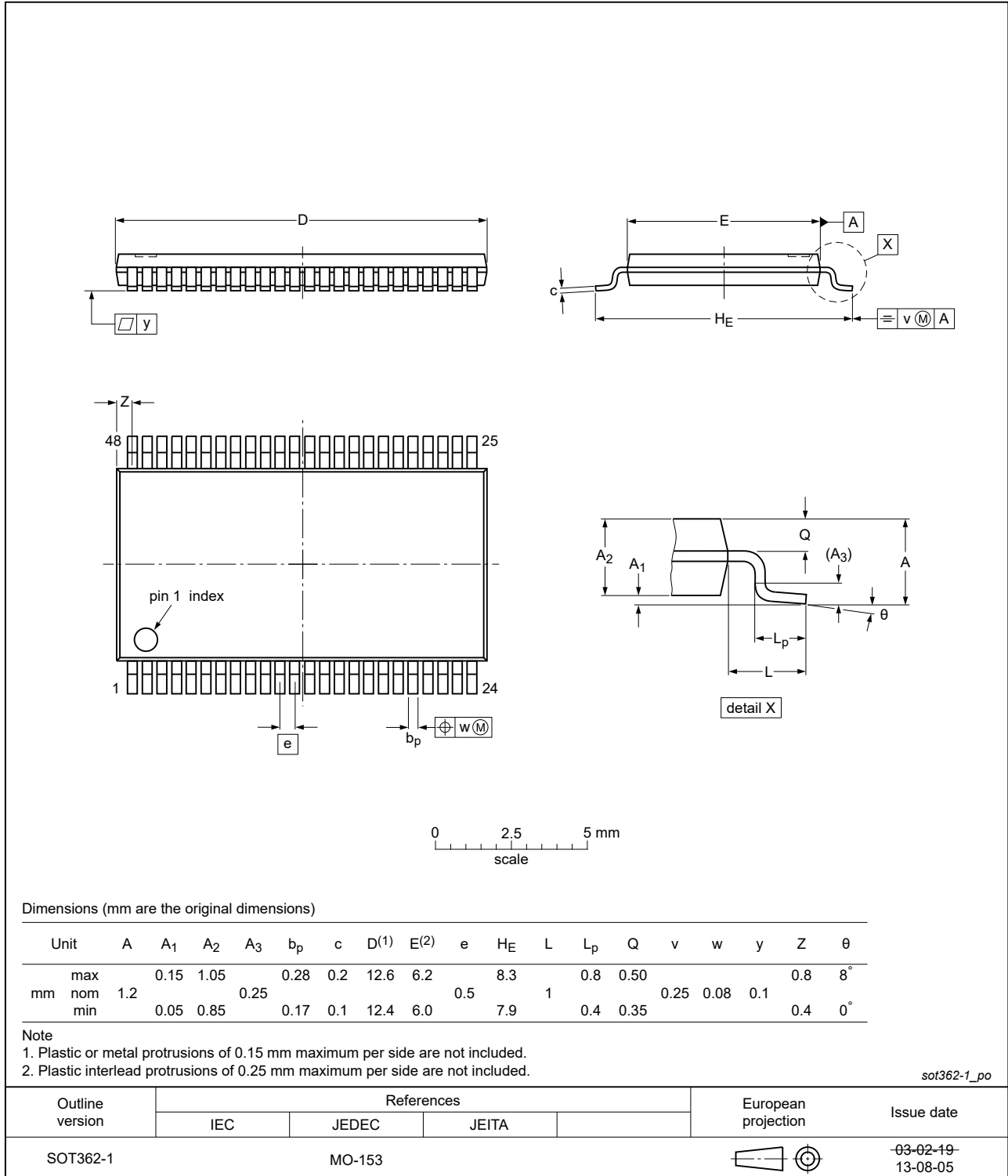


Fig. 9. Package outline SOT362-1 (TSSOP48)

## 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
74LVC16241A v.6	20230804	Product data sheet	-	74LVC16241A v.5
Modifications:	<ul style="list-style-type: none"> <li>• <a href="#">Section 2</a>: ESD specification updated according to the latest JEDEC standard.</li> <li>• <a href="#">Section 7</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li> </ul>			
74LVC16241A v.5	20190426	Product data sheet	-	74LVC16241A 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 74LVC16241ADL (SOT370-1) removed.</li> <li>• Package outline drawing <a href="#">SOT362-1</a> (TSSOP48) updated.</li> </ul>			
74LVC16241A v.4	20111026	Product data sheet	-	74LVC16241A v.3
Modifications:	<ul style="list-style-type: none"> <li>• The format of this document has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>• Legal texts have been adapted to the new company name where appropriate.</li> <li>• <a href="#">Table 4</a>, <a href="#">Table 5</a>, <a href="#">Table 6</a>, <a href="#">Table 7</a>, and <a href="#">Table 9</a>: values added for lower voltage ranges.</li> </ul>			
74LVC16241A v.3	20040305	Product specification	-	74LVC16241A v.2
74LVC16241A v.2	19970729	Product specification	-	74LVC16241A v.1
74LVC16241A v.1	19951226	Product specification	-	-

## 14. Legal information

### 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".
- [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 <https://www.nexperia.com>.

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