

74LVC16240A

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

Rev. 6 — 3 August 2023

Product data sheet

1. General description

The 74LVC16240A is a 16-bit 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 device features four output enables (1OE, 2OE, 3OE and 4OE), each controlling four of the 3-state outputs. A HIGH on nOE causes the outputs to assume a high-impedance OFF-state.

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.

This device is fully specified for partial power-down applications using I_{OFF}. The I_{OFF} circuitry disables the output, preventing the damaging backflow current through the device when it is powered down.

2. Features and benefits

- 5 V tolerant inputs/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
- 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 from -40 °C to +125 °C.

3. Ordering information

Table 1. Ordering information

| Type number | Package | | | Version |
|--------------------------------|-------------------|---------|---|--------------------------|
| | Temperature range | Name | Description | |
| 74LVC16240ADGG | -40 °C to +125 °C | TSSOP48 | plastic thin shrink small outline package; 48 leads; body width 6.1 mm | SOT362-1 |

4. Functional diagram

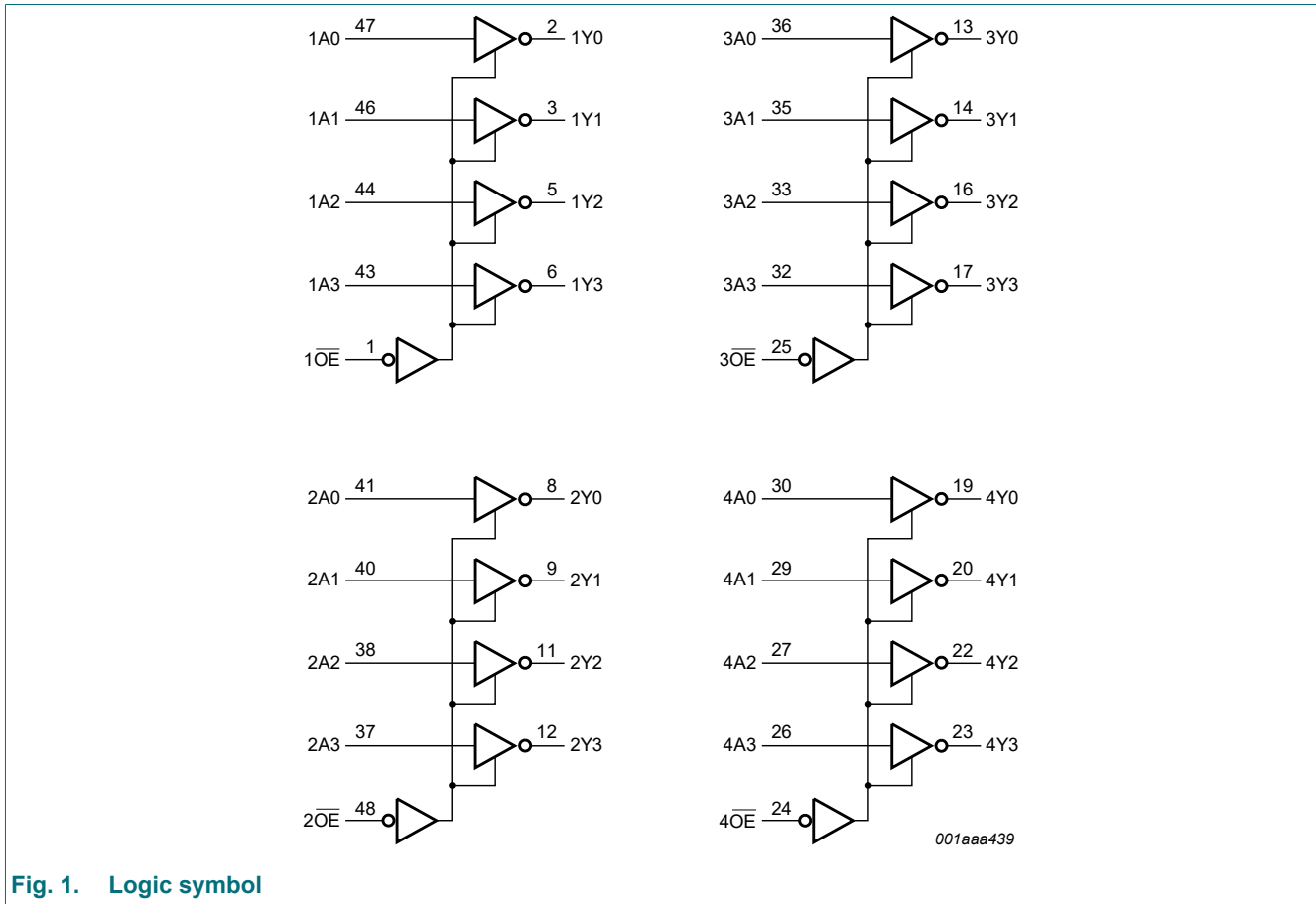


Fig. 1. Logic symbol

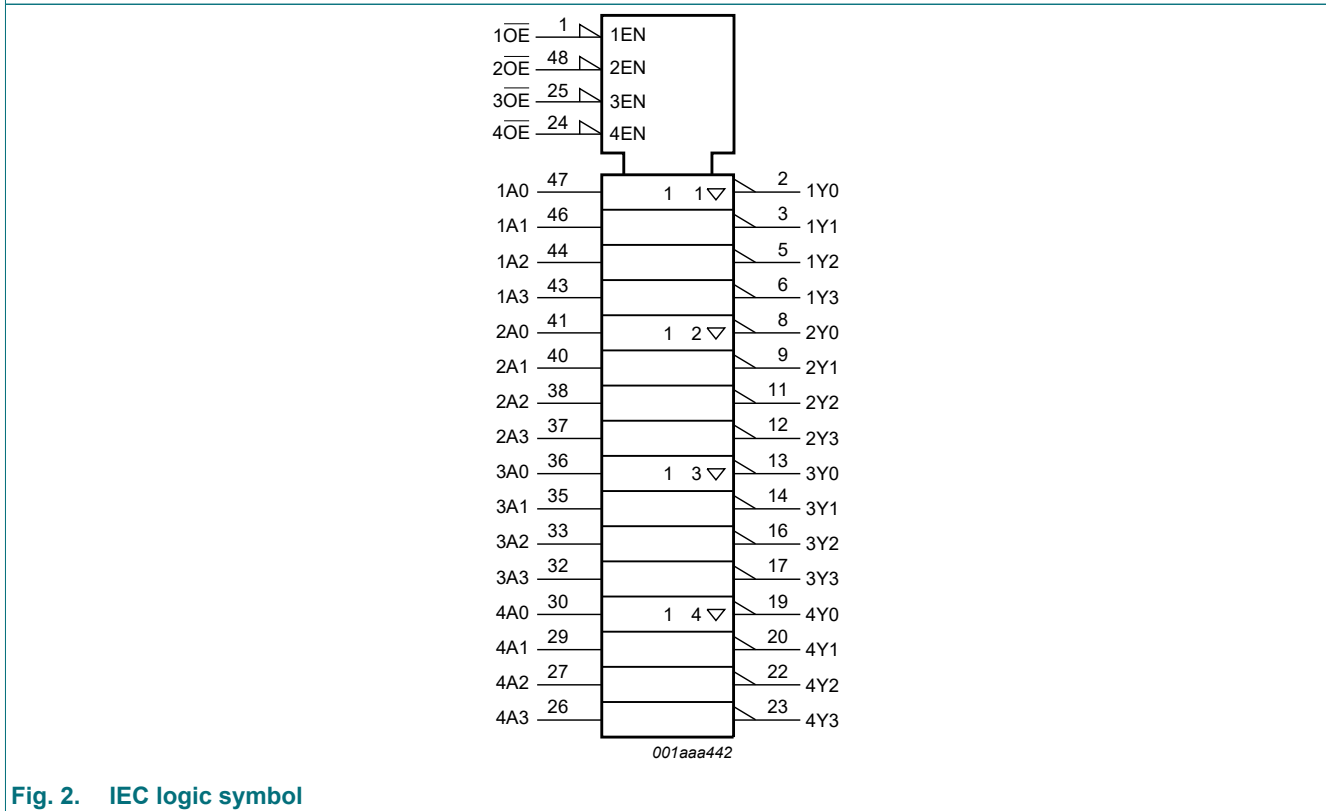


Fig. 2. IEC logic symbol

5. Pinning information

5.1. Pinning

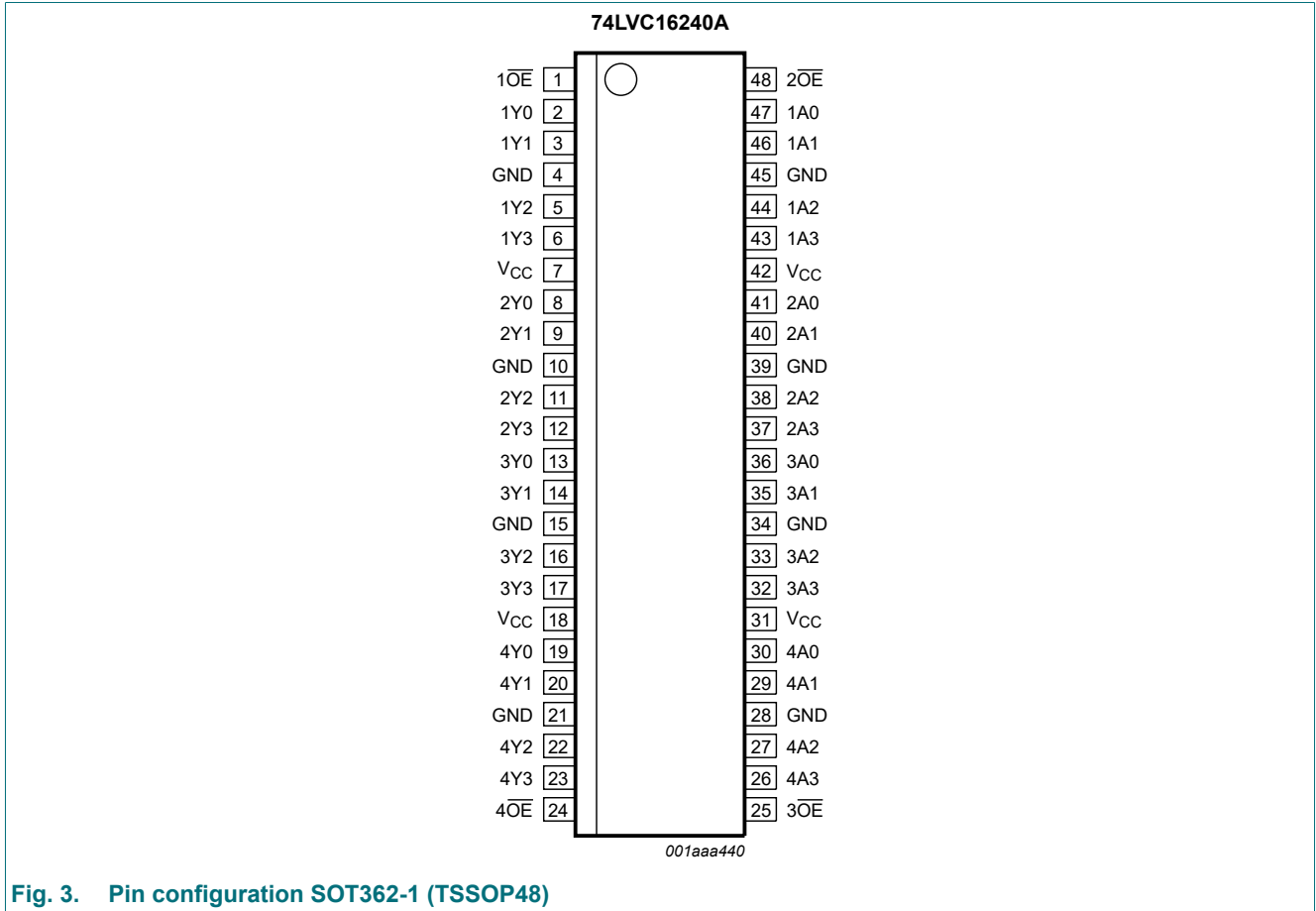


Fig. 3. Pin configuration SOT362-1 (TSSOP48)

5.2. Pin description

Table 2. Pin description

| Name | Pin | Description |
|--------------------|-------------------------------|----------------------------------|
| 1OE, 2OE, 3OE, 4OE | 1, 48, 25, 24 | output enable input (active LOW) |
| GND | 4, 10, 15, 21, 28, 34, 39, 45 | ground (0 V) |
| V _{CC} | 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 |
|-------|-----|--------|
| nOE | nAn | nYn |
| L | L | H |
| L | H | L |
| H | X | 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 | output HIGH or LOW state | [2] | -0.5 | $V_{CC} + 0.5$ | V |
| | | output 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 | output HIGH or LOW state | 0 | - | V_{CC} | V |
| | | output 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 | - | - | 20 | ns/V |
| | | $V_{CC} = 2.7$ 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 | -40 °C to +85 °C | | | -40 °C to +125 °C | | Unit |
|------------------|---------------------------|---|-----------------------|---------|---------------------|-----------------------|---------------------|------|
| | | | Min | Typ [1] | Max | Min | Max | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 1.2 V | 1.08 | - | - | 1.08 | - | V |
| | | V _{CC} = 1.65 V to 1.95 V | 0.65V _{CC} | - | - | 0.65V _{CC} | - | V |
| | | V _{CC} = 2.3 V to 2.7 V | 1.7 | - | - | 1.7 | - | V |
| | | V _{CC} = 2.7 V to 3.6 V | 2.0 | - | - | 2.0 | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 1.2 V | - | - | 0.12 | - | 0.12 | V |
| | | V _{CC} = 1.65 V to 1.95 V | - | - | 0.35V _{CC} | - | 0.35V _{CC} | V |
| | | V _{CC} = 2.3 V to 2.7 V | - | - | 0.7 | - | 0.7 | V |
| | | V _{CC} = 2.7 V to 3.6 V | - | - | 0.8 | - | 0.8 | V |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} | | | | | | |
| | | I _O = -100 μA; V _{CC} = 1.65 V to 3.6 V | V _{CC} - 0.2 | - | - | V _{CC} - 0.3 | - | V |
| | | I _O = -4 mA; V _{CC} = 1.65 V | 1.2 | - | - | 1.05 | - | V |
| | | I _O = -8 mA; V _{CC} = 2.3 V | 1.8 | - | - | 1.65 | - | V |
| | | I _O = -12 mA; V _{CC} = 2.7 V | 2.2 | - | - | 2.05 | - | V |
| | | I _O = -18 mA; V _{CC} = 3.0 V | 2.4 | - | - | 2.25 | - | V |
| | | I _O = -24 mA; V _{CC} = 3.0 V | 2.2 | - | - | 2.0 | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} | | | | | | |
| | | I _O = 100 μA; V _{CC} = 1.65 V to 3.6 V | - | - | 0.2 | - | 0.3 | V |
| | | I _O = 4 mA; V _{CC} = 1.65 V | - | - | 0.45 | - | 0.65 | V |
| | | I _O = 8 mA; V _{CC} = 2.3 V | - | - | 0.6 | - | 0.8 | V |
| | | I _O = 12 mA; V _{CC} = 2.7 V | - | - | 0.4 | - | 0.6 | V |
| | | I _O = 24 mA; V _{CC} = 3.0 V | - | - | 0.55 | - | 0.8 | V |
| I _I | input leakage current | V _{CC} = 3.6 V; V _I = 5.5 V or GND | - | ±0.1 | ±5 | - | ±20 | μA |
| I _{OZ} | OFF-state output current | V _I = V _{IH} or V _{IL} ; V _{CC} = 3.6 V; V _O = 5.5 V or GND | - | 0.1 | ±5 | - | ±20 | μA |
| I _{OFF} | power-off leakage current | V _{CC} = 0 V; V _I or V _O = 5.5 V | - | 0.1 | ±10 | - | ±20 | μA |
| I _{CC} | supply current | V _{CC} = 3.6 V; V _I = V _{CC} or GND; I _O = 0 A | - | 0.1 | 20 | - | 80 | μA |
| ΔI _{CC} | additional supply current | per input pin; V _{CC} = 2.7 V to 3.6 V; V _I = V _{CC} - 0.6 V; I _O = 0 A | - | 5 | 500 | - | 5000 | μA |
| C _I | input capacitance | V _{CC} = 0 V to 3.6 V; V _I = GND to V _{CC} | - | 5.0 | - | - | - | pF |

[1] All typical values are measured at V_{CC} = 3.3 V (unless stated otherwise) and T_{amb} = 25 °C.

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). For test circuit see Fig. 6.

| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | -40 °C to +125 °C | | Unit |
|-------------|-------------------------------|--|------------------|---------|------|-------------------|------|------|
| | | | Min | Typ [1] | Max | Min | Max | |
| t_{pd} | propagation delay | nAn to nYn; see Fig. 4 [2] | | | | | | |
| | | $V_{CC} = 1.2\text{ V}$ | - | 12.0 | - | - | - | ns |
| | | $V_{CC} = 1.65\text{ V to }1.95\text{ V}$ | 1.0 | 5.1 | 11.0 | 1.0 | 11.7 | ns |
| | | $V_{CC} = 2.3\text{ V to }2.7\text{ V}$ | 0.5 | 2.7 | 5.5 | 0.5 | 6.1 | ns |
| | | $V_{CC} = 2.7\text{ V}$ | 1.0 | 2.7 | 5.2 | 1.0 | 6.5 | ns |
| t_{en} | enable time | nOE to nYn; see Fig. 5 [2] | | | | | | |
| | | $V_{CC} = 1.2\text{ V}$ | - | 18.0 | - | - | - | ns |
| | | $V_{CC} = 1.65\text{ V to }1.95\text{ V}$ | 1.5 | 6.6 | 12.8 | 1.5 | 13.5 | ns |
| | | $V_{CC} = 2.3\text{ V to }2.7\text{ V}$ | 1.0 | 3.8 | 6.8 | 1.0 | 7.5 | ns |
| | | $V_{CC} = 2.7\text{ V}$ | 1.5 | 3.5 | 5.8 | 1.5 | 7.5 | ns |
| t_{dis} | disable time | nOE to nYn; see Fig. 5 [2] | | | | | | |
| | | $V_{CC} = 1.2\text{ V}$ | - | 11.0 | - | - | - | ns |
| | | $V_{CC} = 1.65\text{ V to }1.95\text{ V}$ | 2.9 | 4.7 | 9.2 | 2.9 | 9.7 | ns |
| | | $V_{CC} = 2.3\text{ V to }2.7\text{ V}$ | 1.0 | 2.6 | 5.0 | 1.0 | 5.6 | ns |
| | | $V_{CC} = 2.7\text{ V}$ | 1.5 | 3.5 | 5.1 | 1.5 | 6.5 | ns |
| $t_{sk(o)}$ | output skew time | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$ [3] | - | - | 1.0 | - | 1.5 | ns |
| | | | | | | | | |
| C_{PD} | power dissipation capacitance | per input; $V_I = \text{GND to } V_{CC}$ [4] | | | | | | |
| | | $V_{CC} = 1.65\text{ V to }1.95\text{ V}$ | - | 4.8 | - | - | - | pF |
| | | $V_{CC} = 2.3\text{ V to }2.7\text{ V}$ | - | 8.3 | - | - | - | pF |
| | | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$ | - | 11.4 | - | - | - | pF |

[1] Typical values are measured at $T_{amb} = 25\text{ °C}$ and $V_{CC} = 1.2\text{ V}, 1.8\text{ V}, 2.5\text{ V}, 2.7\text{ V},$ and 3.3 V respectively.

[2] t_{pd} is the same as t_{PLH} and t_{PHL} .

t_{en} is the same as t_{PZL} and t_{PZH} .

t_{dis} is the same as t_{PLZ} and t_{PHZ} .

[3] Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.

[4] C_{PD} is used to determine the dynamic power dissipation (P_D 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_i = input frequency in MHz; f_o = output frequency in MHz

C_L = output load capacitance in pF

V_{CC} = 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

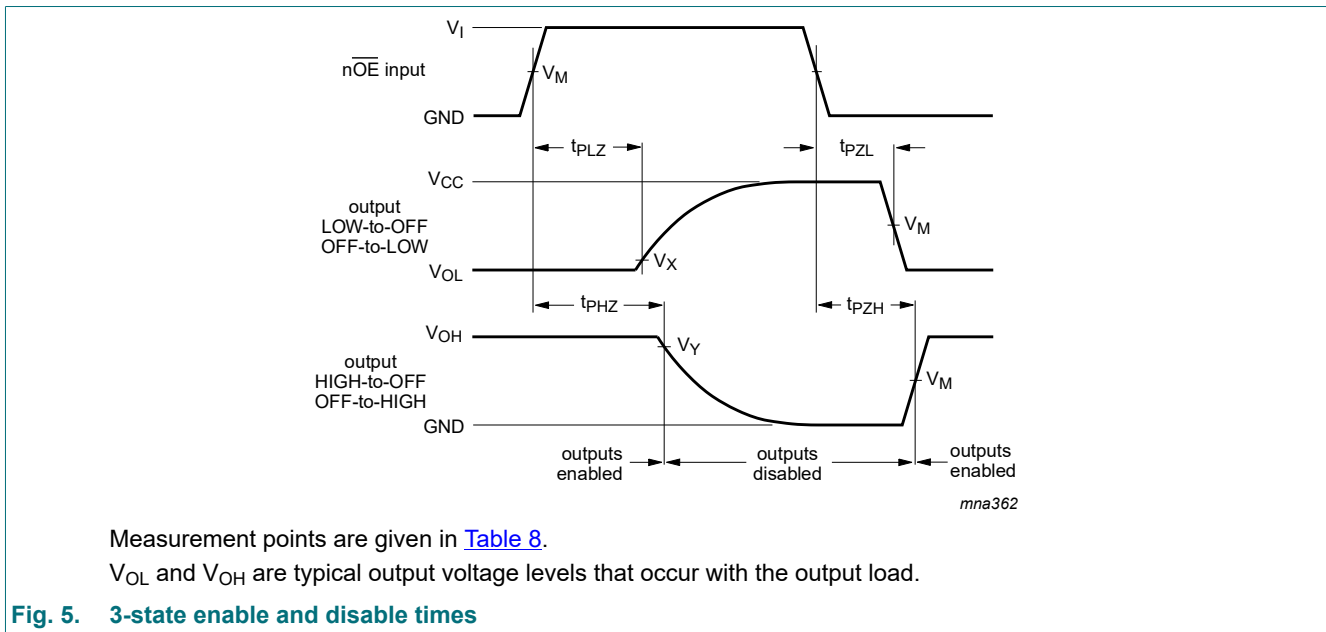
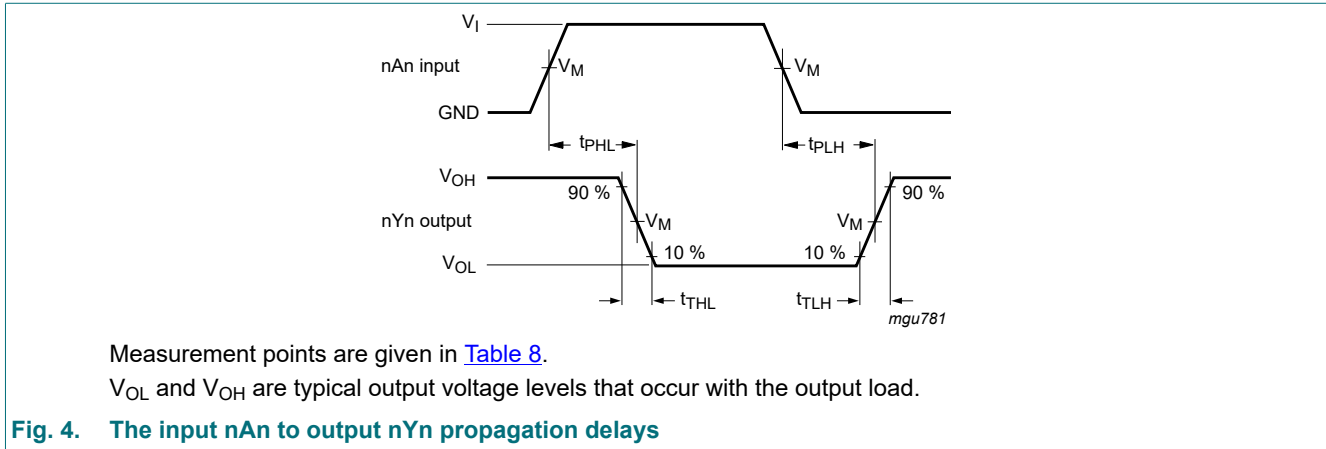


Table 8. Measurement points

| Supply voltage | Input | Output | | |
|------------------|---------------------|---------------------|--------------------------|--------------------------|
| V_{CC} | V_M | V_M | V_X | V_Y |
| 1.2 V | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ | $V_{OL} + 0.1 \text{ V}$ | $V_{OH} - 0.1 \text{ V}$ |
| 1.65 V to 1.95 V | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ | $V_{OL} + 0.1 \text{ V}$ | $V_{OH} - 0.1 \text{ V}$ |
| 2.3 V to 2.7 V | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ | $V_{OL} + 0.1 \text{ V}$ | $V_{OH} - 0.1 \text{ V}$ |
| 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 | $V_{OL} + 0.3 \text{ V}$ | $V_{OH} - 0.3 \text{ V}$ |

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

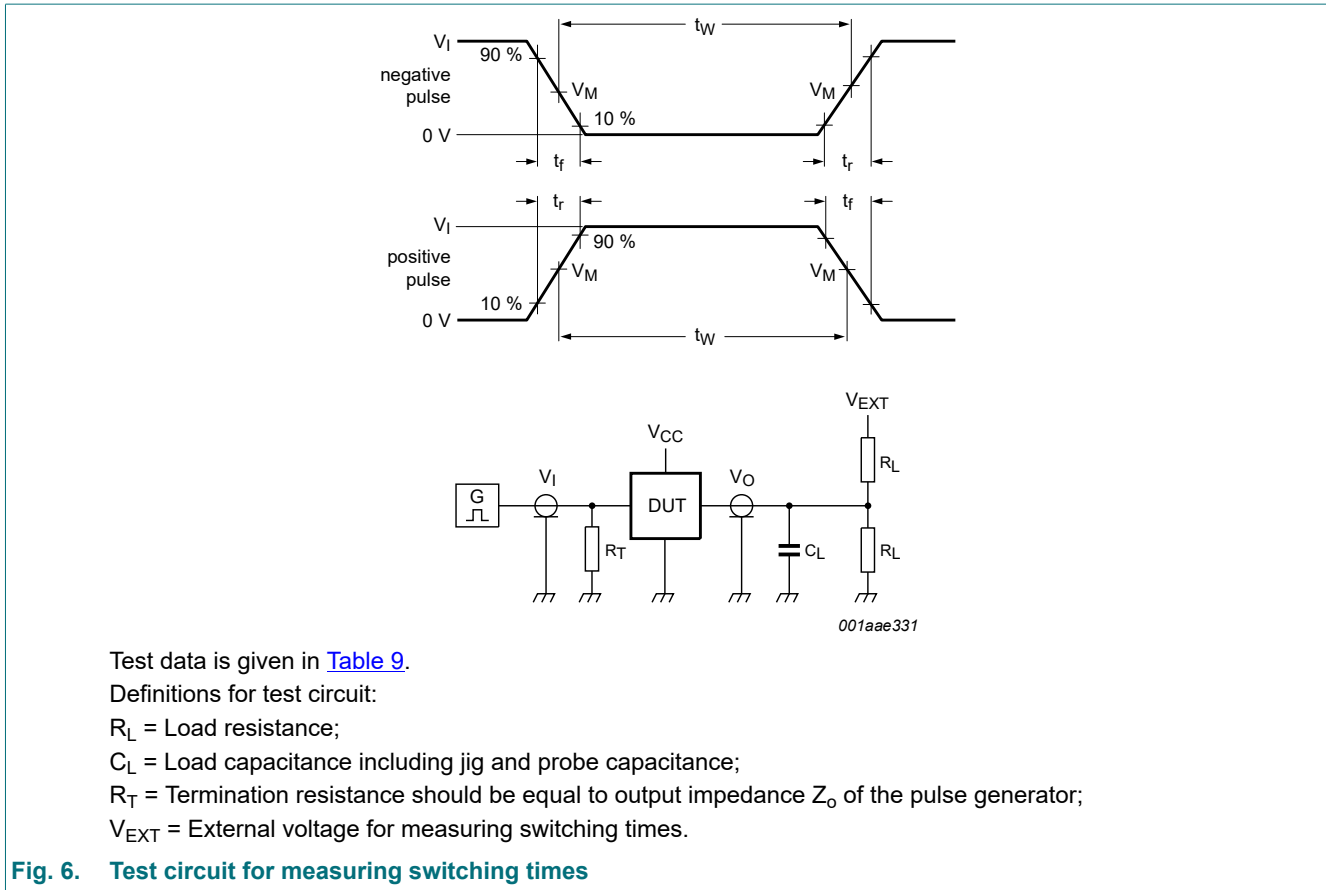


Table 9. Test data

| 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} | ≤ 2 ns | 30 pF | 1 k Ω | open | $2 \times V_{CC}$ | GND |
| 1.65 V to 1.95 V | V_{CC} | ≤ 2 ns | 30 pF | 1 k Ω | open | $2 \times V_{CC}$ | GND |
| 2.3 V to 2.7 V | V_{CC} | ≤ 2 ns | 30 pF | 500 Ω | open | $2 \times V_{CC}$ | GND |
| 2.7 V | 2.7 V | ≤ 2.5 ns | 50 pF | 500 Ω | open | $2 \times V_{CC}$ | GND |
| 3.0 V to 3.6 V | 2.7 V | ≤ 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

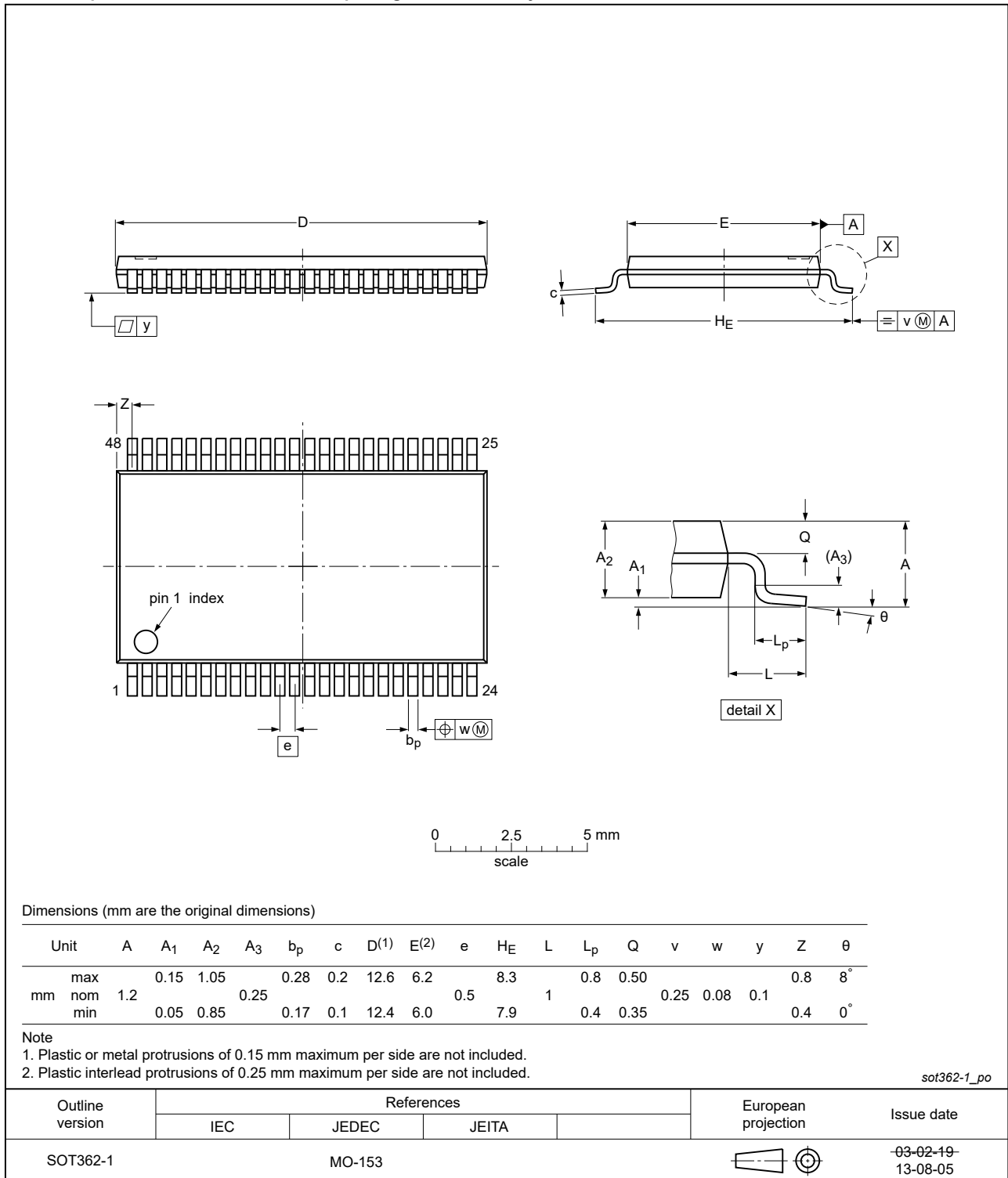


Fig. 7. Package outline SOT362-1 (TSSOP48)

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 |
|-----------------|---|-----------------------|---------------|-----------------|
| 74LVC16240A v.6 | 20230803 | Product data sheet | - | 74LVC16240A v.5 |
| Modifications: | <ul style="list-style-type: none"> • Section 2: ESD specification updated according to the latest JEDEC standard. • Section 7: Derating values for P_{tot} total power dissipation updated. | | | |
| 74LVC16240A v.5 | 20190425 | Product data sheet | - | 74LVC16240A v.4 |
| Modifications: | <ul style="list-style-type: none"> • 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 74LVC16240ADL (SOT370-1) removed. • Package outline drawing SOT362-1 (TSSOP48) updated. • Typo corrected in Section 5.2. | | | |
| 74LVC16240A v.4 | 20111103 | Product data sheet | - | 74LVC16240A v.3 |
| Modifications: | <ul style="list-style-type: none"> • The format of this document has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • Table 4, Table 5, Table 6, Table 7, and Table 9: values added for lower voltage ranges. | | | |
| 74LVC16240A v.3 | 20040305 | Product specification | - | 74LVC16240A v.2 |
| 74LVC16240A v.2 | 19970729 | Product specification | - | 74LVC16240A v.1 |
| 74LVC16240A 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. |
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| Product [short] data sheet | Production | This document contains the product specification. |

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- [2] The term 'short data sheet' is explained in section "Definitions".
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