

74LVC244A; 74LVCH244A

Octal buffer/line driver; 3-state

Rev. 10 — 8 April 2020

Product data sheet

1. General description

The 74LVC244A; 74LVCH244A is an octal non-inverting buffer/line driver with 3-state outputs. The 3-state outputs are controlled by the output enable inputs $1\overline{OE}$ and $2\overline{OE}$. A HIGH on $n\overline{OE}$ causes the outputs to assume a high-impedance OFF-state. Schmitt-trigger action at all inputs makes the circuit highly tolerant for slower input rise and fall times.

Inputs can be driven from either 3.3 V or 5.0 V devices. In 3-state operation, outputs can handle 5 V. These features allow the use of these devices as translators in a mixed 3.3 V and 5 V environment.

The 74LVCH244A bus hold on data inputs eliminates the need for external pull-up resistors to hold unused inputs.

2. Features and benefits

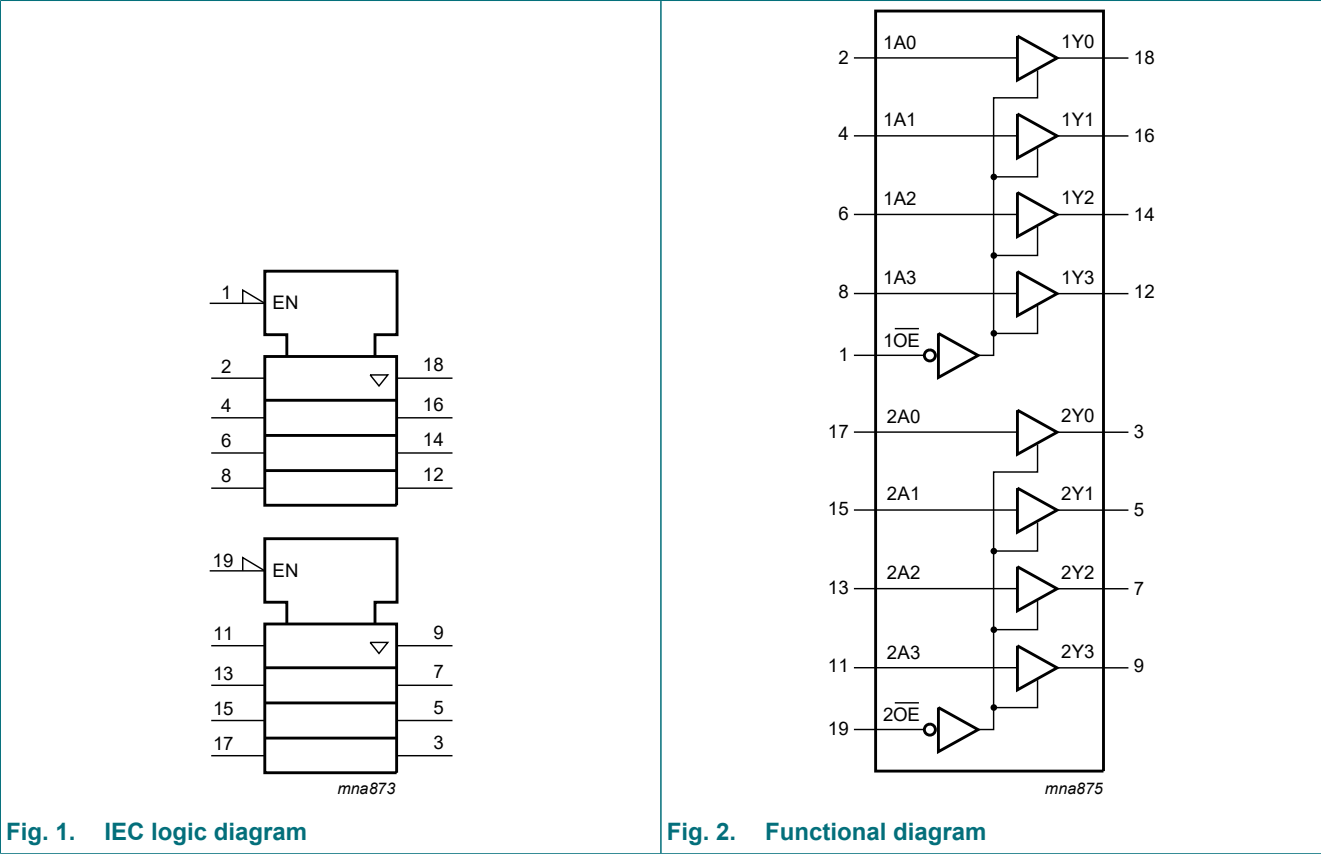
- 5 V tolerant inputs/outputs for interfacing with 5 V logic
- Wide supply voltage range from 1.2 V to 3.6 V
- CMOS low-power consumption
- Direct interface with TTL levels
- Inputs accept voltages up to 5.5 V
- High-impedance when $V_{CC} = 0$ V
- Bus hold on all data inputs (74LVCH244A only)
- Complies 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 JESD22-A114F exceeds 2000 V
 - MM JESD22-A115B exceeds 200 V
 - CDM JESD22-C101E 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 |
| 74LVC244AD | -40 °C to +125 °C | SO20 | plastic small outline package; 20 leads; body width 7.5 mm | SOT163-1 |
| 74LVCH244AD | | | | |
| 74LVC244ADB | -40 °C to +125 °C | SSOP20 | plastic shrink small outline package; 20 leads; body width 5.3 mm | SOT339-1 |
| 74LVCH244ADB | | | | |
| 74LVC244APW | -40 °C to +125 °C | TSSOP20 | plastic thin shrink small outline package; 20 leads; body width 4.4 mm | SOT360-1 |
| 74LVCH244APW | | | | |
| 74LVC244ABQ | -40 °C to +125 °C | DHVQFN20 | plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body 2.5 × 4.5 × 0.85 mm | SOT764-1 |
| 74LVCH244ABQ | | | | |

4. Functional diagram



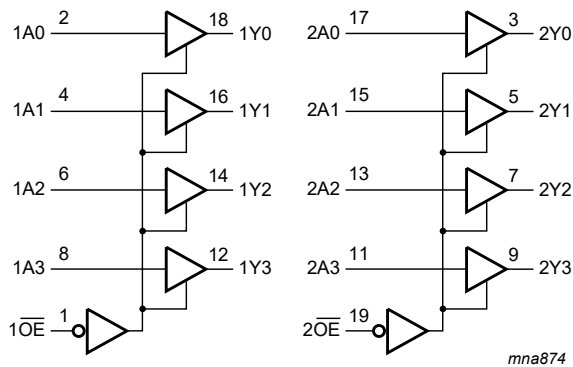


Fig. 3. Logic symbol

5. Pinning information

5.1. Pinning

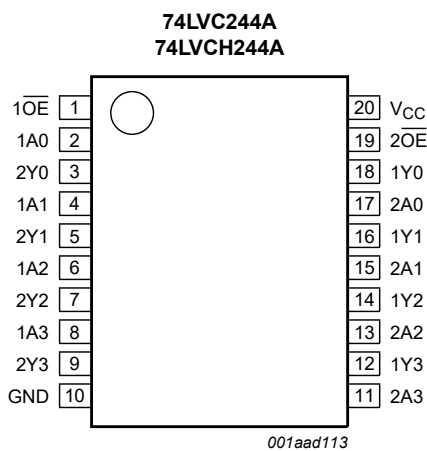


Fig. 4. Pin configuration SOT163-1 (SO20), SOT339-1 (SSOP20) and SOT360-1 (TSSOP20)

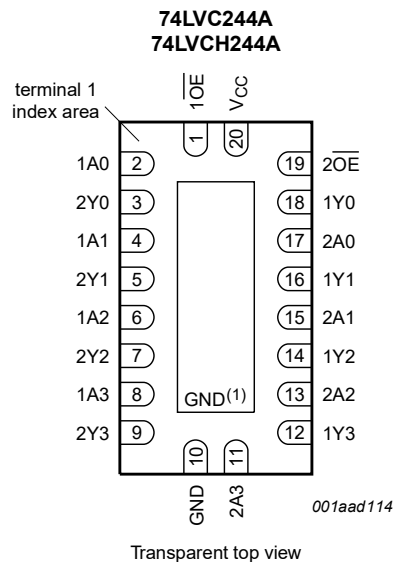


Fig. 5. Pin configuration SOT764-1 (DHVQFN20)

5.2. Pin description

Table 2. Pin description

| Symbol | Pin | Description |
|-------------------------------------|----------------|----------------------------------|
| $1\overline{OE}$, $2\overline{OE}$ | 1, 19 | output enable input (active low) |
| 1A0, 1A1, 1A2, 1A3 | 2, 4, 6, 8 | data input |
| 2Y0, 2Y1, 2Y2, 2Y3 | 3, 5, 7, 9 | data output |
| GND | 10 | ground (0 V) |
| 2A0, 2A1, 2A2, 2A3 | 17, 15, 13, 11 | data input |
| 1Y0, 1Y1, 1Y2, 1Y3, | 18, 16, 14, 12 | data output |
| V_{CC} | 20 | supply voltage |

6. Functional description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high-impedance OFF-state.

| Control | Input | Output |
|------------------|-------|--------|
| $n\overline{OE}$ | nAn | nYn |
| L | L | L |
| L | H | H |
| 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 [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 SOT163-1 (SO20) package: P_{tot} derates linearly with 12.3 mW/K above 109 °C.

For SOT339-1 (SSOP20) package: P_{tot} derates linearly with 10.0 mW/K above 100 °C.

For SOT360-1 (TSSOP20) package: P_{tot} derates linearly with 10.0 mW/K above 100 °C.

For SOT764-1 (DHVQFN20) package: P_{tot} derates linearly with 12.9 mW/K above 111 °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 | - | 3.6 | V |
| V _I | input voltage | | 0 | - | 5.5 | V |
| V _O | output voltage | output HIGH or LOW | 0 | - | V _{CC} | V |
| | | output 3-state | 0 | - | 5.5 | V |
| T _{amb} | ambient temperature | in free air | -40 | - | +125 | °C |
| Δt/ΔV | input transition rise and fall rate | V _{CC} = 1.2 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 _{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 |

| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | -40 °C to +125 °C | | Unit |
|-----------------|---------------------------------|---|------------------|-----------|----------|-------------------|----------|---------------|
| | | | Min | Typ [1] | Max | Min | Max | |
| I_I | input leakage current | $V_I = 5.5 \text{ V}$ or GND; $V_{CC} = 3.6 \text{ V}$ [2] | - | ± 0.1 | ± 5 | - | ± 20 | μA |
| I_{OZ} | OFF-state output current | $V_I = V_{IH}$ or V_{IL} ; $V_O = 5.5 \text{ V}$ or GND; $V_{CC} = 3.6 \text{ V}$ [2] | - | ± 0.1 | ± 5 | - | ± 20 | μA |
| I_{OFF} | power-off leakage current | V_I or $V_O = 5.5 \text{ V}$; $V_{CC} = 0.0 \text{ V}$ | - | ± 0.1 | ± 10 | - | ± 20 | μA |
| I_{CC} | supply current | $V_I = V_{CC}$ or GND; $I_O = 0 \text{ A}$; $V_{CC} = 3.6 \text{ V}$ | - | 0.1 | 10 | - | 40 | μA |
| ΔI_{CC} | additional supply current | per input pin; $V_I = V_{CC} - 0.6 \text{ V}$; $I_O = 0 \text{ A}$; $V_{CC} = 2.7 \text{ V}$ to 3.6 V | - | 5 | 500 | - | 5000 | μA |
| C_I | input capacitance | | - | 4.0 | - | - | - | pF |
| I_{BHL} | bus hold LOW current | $V_{CC} = 1.65 \text{ V}$; $V_I = 0.58 \text{ V}$ [3][4] | 10 | - | - | 10 | - | μA |
| | | $V_{CC} = 2.3 \text{ V}$; $V_I = 0.7 \text{ V}$ | 30 | - | - | 25 | - | μA |
| | | $V_{CC} = 3.0 \text{ V}$; $V_I = 0.8 \text{ V}$ | 75 | - | - | 60 | - | μA |
| I_{BHH} | bus hold HIGH current | $V_{CC} = 1.65 \text{ V}$; $V_I = 1.07 \text{ V}$ [3][4] | -10 | - | - | -10 | - | μA |
| | | $V_{CC} = 2.3 \text{ V}$; $V_I = 1.7 \text{ V}$ | -30 | - | - | -25 | - | μA |
| | | $V_{CC} = 3.0 \text{ V}$; $V_I = 2.0 \text{ V}$ | -75 | - | - | -60 | - | μA |
| I_{BHLO} | bus hold LOW overdrive current | $V_{CC} = 1.95 \text{ V}$ [3][5] | 200 | - | - | 200 | - | μA |
| | | $V_{CC} = 2.7 \text{ V}$ | 300 | - | - | 300 | - | μA |
| | | $V_{CC} = 3.6 \text{ V}$ | 500 | - | - | 500 | - | μA |
| I_{BHHO} | bus hold HIGH overdrive current | $V_{CC} = 1.95 \text{ V}$ [3][5] | -200 | - | - | -200 | - | μA |
| | | $V_{CC} = 2.7 \text{ V}$ | -300 | - | - | -300 | - | μA |
| | | $V_{CC} = 3.6 \text{ V}$ | -500 | - | - | -500 | - | μA |

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

[2] The bus hold circuit is switched off when $V_I > V_{CC}$ allowing 5.5 V on the input terminal.

[3] Valid for data inputs of bus hold parts only (74LVCH244A). Note that control inputs do not have a bus hold circuit.

[4] The specified sustaining current at the data input holds the input below the specified V_I level.

[5] The specified overdrive current at the data input forces the data input to the opposite input state.

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_{pd} | propagation delay | nAn to nYn; see Fig. 6 [2] | | | | | | |
| | | $V_{CC} = 1.2\text{ V}$ | - | 17.0 | - | - | - | ns |
| | | $V_{CC} = 1.65\text{ V to }1.95\text{ V}$ | 1.5 | 6.4 | 13.7 | 1.5 | 15.8 | ns |
| | | $V_{CC} = 2.3\text{ V to }2.7\text{ V}$ | 1.0 | 3.4 | 7.1 | 1.0 | 8.2 | ns |
| | | $V_{CC} = 2.7\text{ V}$ | 1.5 | 3.4 | 6.9 | 1.5 | 9.0 | ns |
| | | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$ | 1.5 | 2.9 | 5.9 | 1.5 | 7.5 | ns |
| t_{en} | enable time | nOE to nYn; see Fig. 7 [2] | | | | | | |
| | | $V_{CC} = 1.2\text{ V}$ | - | 24.0 | - | - | - | ns |
| | | $V_{CC} = 1.65\text{ V to }1.95\text{ V}$ | 1.5 | 7.0 | 17.3 | 1.5 | 20.0 | ns |
| | | $V_{CC} = 2.3\text{ V to }2.7\text{ V}$ | 1.5 | 3.9 | 9.5 | 1.5 | 11.0 | ns |
| | | $V_{CC} = 2.7\text{ V}$ | 1.5 | 4.1 | 8.6 | 1.5 | 11.0 | ns |
| | | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$ | 1.0 | 3.2 | 7.6 | 1.0 | 9.5 | ns |
| t_{dis} | disable time | nOE to nYn; see Fig. 7 [2] | | | | | | |
| | | $V_{CC} = 1.2\text{ V}$ | - | 9.0 | - | - | - | ns |
| | | $V_{CC} = 1.65\text{ V to }1.95\text{ V}$ | 2.2 | 4.5 | 9.8 | 2.2 | 11.3 | ns |
| | | $V_{CC} = 2.3\text{ V to }2.7\text{ V}$ | 0.5 | 3.6 | 5.5 | 0.5 | 6.4 | ns |
| | | $V_{CC} = 2.7\text{ V}$ | 1.5 | 3.3 | 6.8 | 1.5 | 8.5 | ns |
| | | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$ | 1.5 | 3.1 | 5.8 | 1.5 | 7.5 | ns |
| $t_{sk(o)}$ | output skew time | [3] | - | - | 1.0 | - | 1.5 | ns |
| C_{PD} | power dissipation capacitance | per input; $V_I = \text{GND to } V_{CC}$ [4] | | | | | | |
| | | $V_{CC} = 1.65\text{ V to }1.95\text{ V}$ | - | 6.4 | - | - | - | pF |
| | | $V_{CC} = 2.3\text{ V to }2.7\text{ V}$ | - | 9.6 | - | - | - | pF |
| | | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$ | - | 12.5 | - | - | - | 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

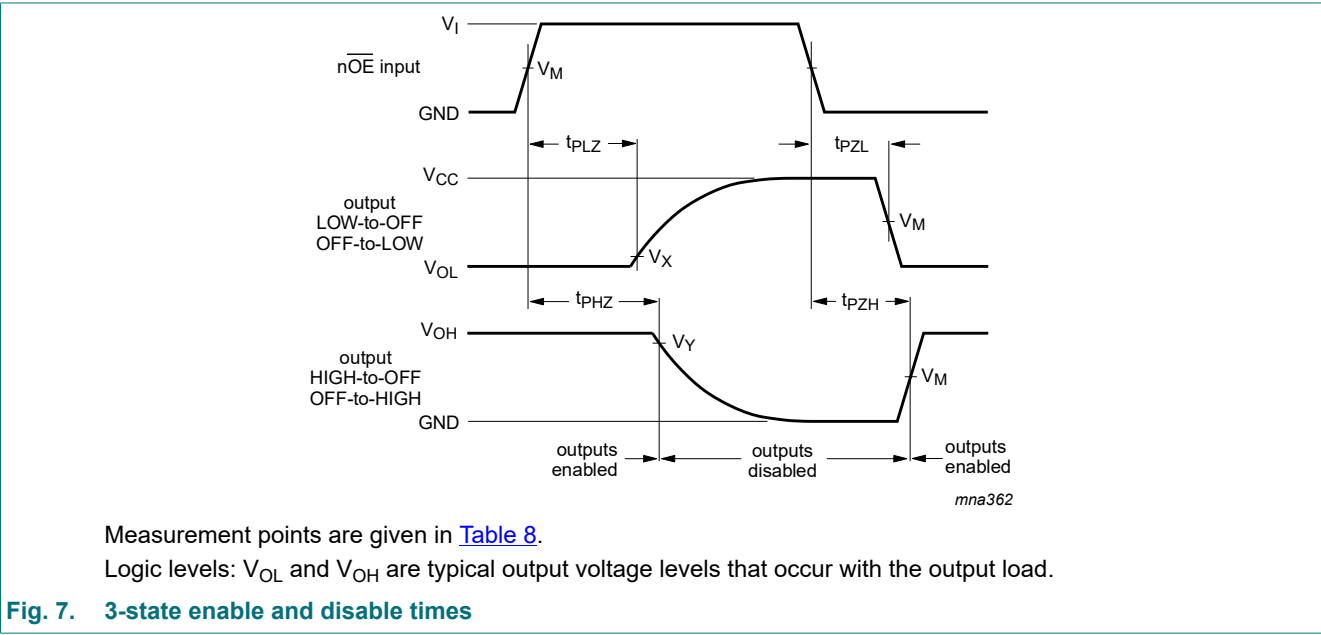
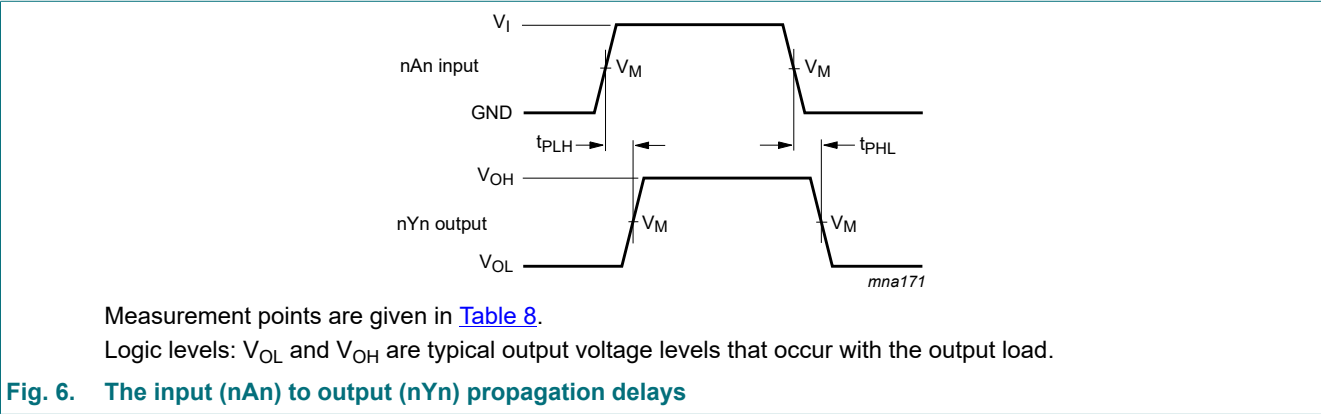
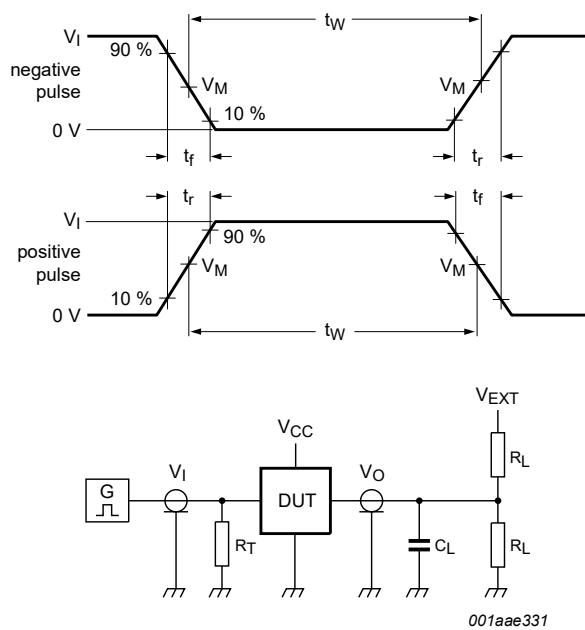


Table 8. Measurement points

| Supply voltage | Input | | Output | | |
|------------------|----------|---------------------|---------------------|---------------------------|---------------------------|
| V_{CC} | V_I | V_M | V_M | V_X | V_Y |
| 1.2 V | V_{CC} | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ | $V_{OL} + 0.15 \text{ V}$ | $V_{OH} - 0.15 \text{ V}$ |
| 1.65 V to 1.95 V | V_{CC} | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ | $V_{OL} + 0.15 \text{ V}$ | $V_{OH} - 0.15 \text{ V}$ |
| 2.3 V to 2.7 V | V_{CC} | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ | $V_{OL} + 0.15 \text{ V}$ | $V_{OH} - 0.15 \text{ V}$ |
| 2.7 V | 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 | 2.7 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} | ≤ 2 ns | 30 pF | 1 kΩ | open | 2 × V _{CC} | GND |
| 1.65 V to 1.95 V | V _{CC} | ≤ 2 ns | 30 pF | 1 kΩ | open | 2 × V _{CC} | GND |
| 2.3 V to 2.7 V | V _{CC} | ≤ 2 ns | 30 pF | 500 Ω | open | 2 × V _{CC} | GND |
| 2.7 V | 2.7 V | ≤ 2.5 ns | 50 pF | 500 Ω | open | 2 × V _{CC} | GND |
| 3.0 V to 3.6 V | 2.7 V | ≤ 2.5 ns | 50 pF | 500 Ω | open | 2 × V _{CC} | GND |

11. Package outline

SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1



Fig. 9. Package outline SOT163-1 (SO20)

SSOP20: plastic shrink small outline package; 20 leads; body width 5.3 mm

SOT339-1

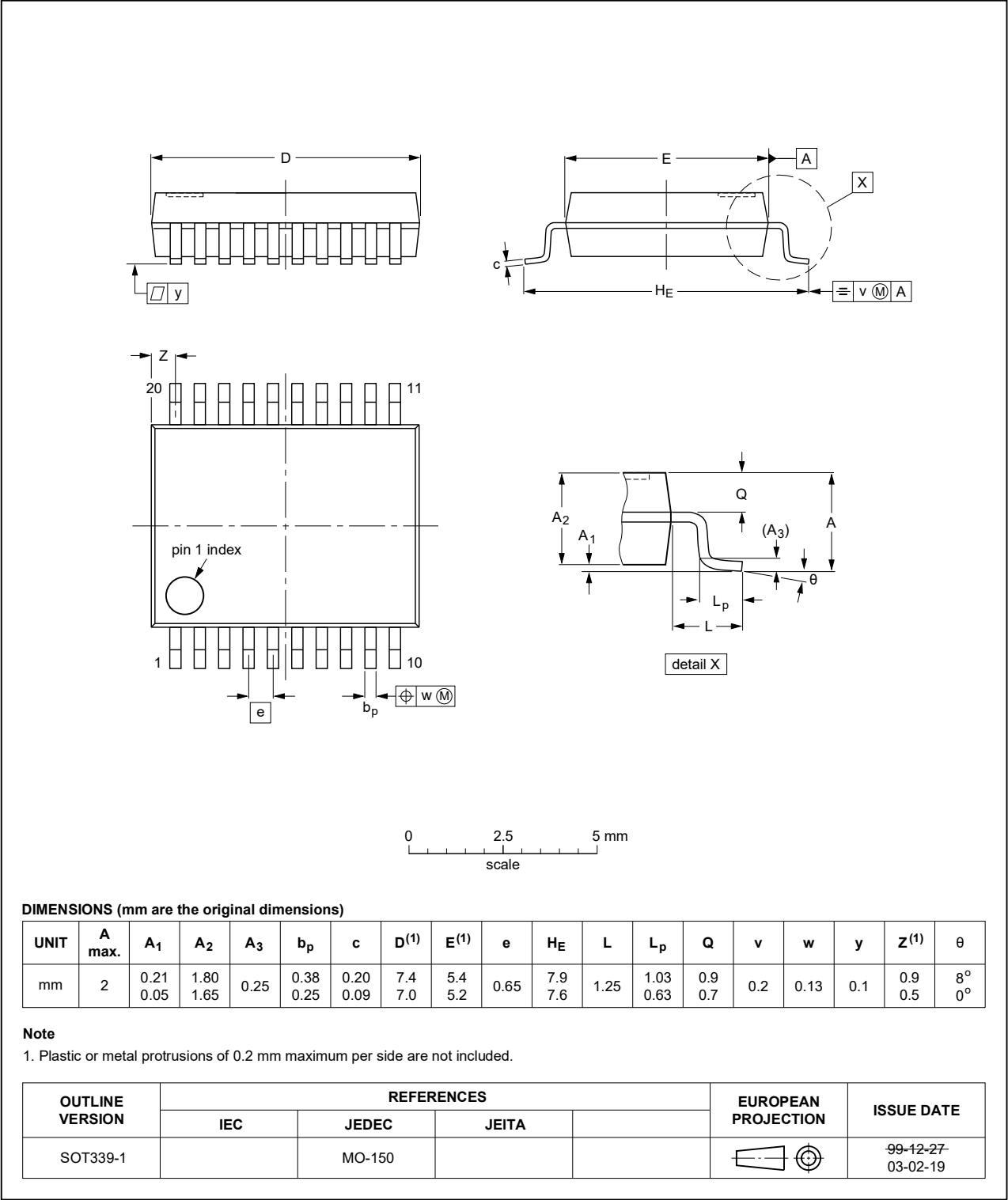


Fig. 10. Package outline SOT339-1 (SSOP20)

TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm

SOT360-1



Fig. 11. Package outline SOT360-1 (TSSOP20)

DHVQFN20: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads;
20 terminals; body 2.5 x 4.5 x 0.85 mm

SOT764-1

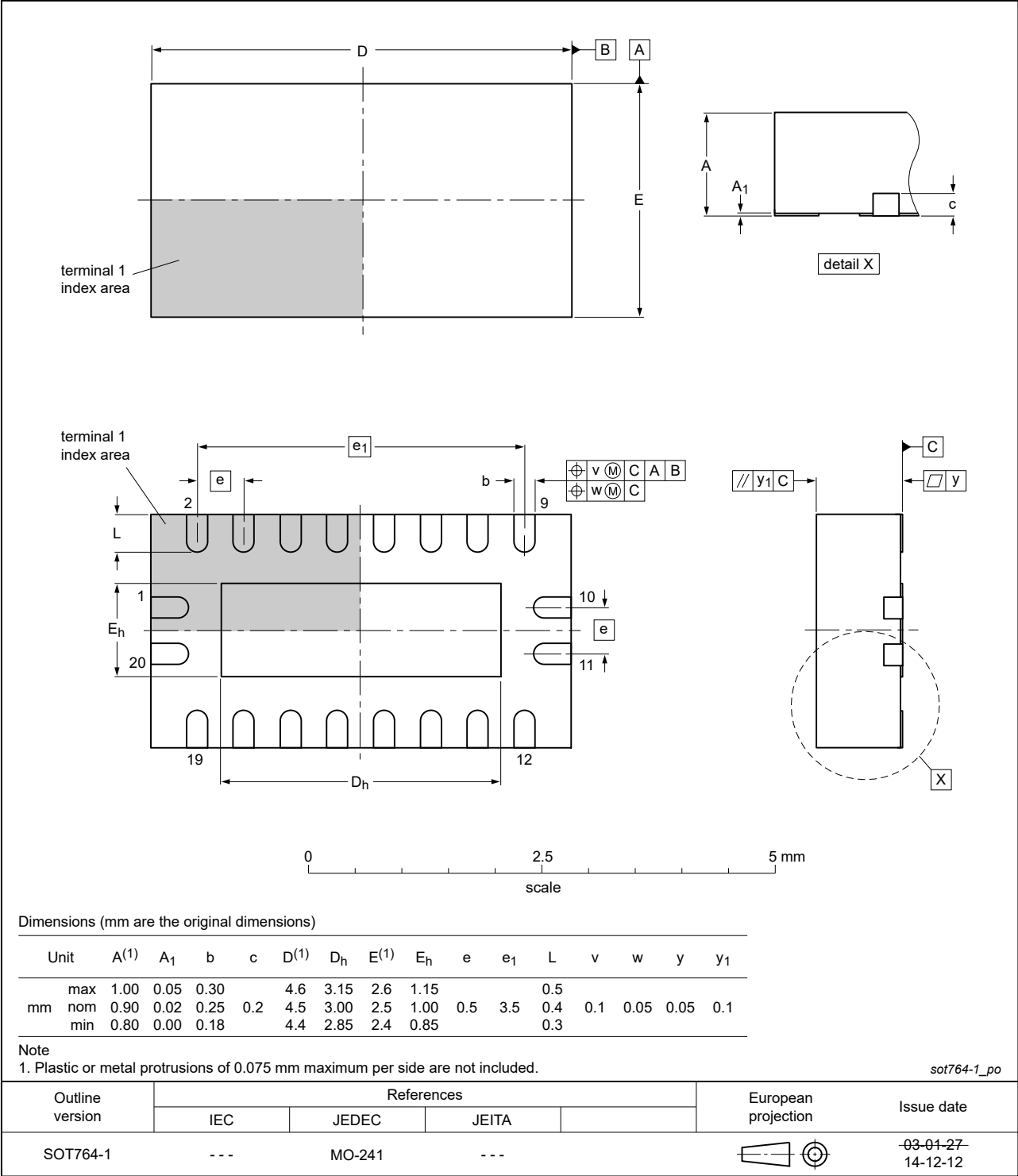


Fig. 12. Package outline SOT764-1 (DHVQFN20)

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 |
| MM | Machine Model |
| TTL | Transistor-Transistor Logic |

13. Revision history

Table 11. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|--------------------------|--|-----------------------|---------------|--------------------------|
| 74LVC_LVCH244A v.10 | 20200408 | Product data sheet | - | 74LVC_LVCH244A v.9 |
| Modifications: | <ul style="list-style-type: none"> Table 4: Derating values for P_{tot} total power dissipation updated. | | | |
| 74LVC_LVCH244A v.9 | 20180813 | Product data sheet | - | 74LVC_LVCH244A v.8 |
| 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 numbers 74LVC244ABX and 74LVCH244ABX (SOT1045-2) removed. | | | |
| 74LVC_LVCH244A v.8 | 20130626 | Product data sheet | - | 74LVC_LVCH244A v.7 |
| Modifications: | <ul style="list-style-type: none"> For type numbers 74LVC244ABX and 74LVCH244ABX DHXQFN20U (SOT1045-1) has changed to DHXQFN20 (SOT1045-2). | | | |
| 74LVC_LVCH244A v.7 | 20111122 | Product data sheet | - | 74LVC_LVCH244A v.6 |
| 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, Table 8 and Table 9: values added for lower voltage ranges. | | | |
| 74LVC_LVCH244A v.6 | 20090813 | Product data sheet | - | 74LVC_LVCH244A v.5 |
| 74LVC_LVCH244A v.5 | 20090709 | Product data sheet | - | 74LVC_LVCH244A v.4 |
| 74LVC_LVCH244A v.4 | 20031030 | Product specification | - | 74LVC_LVCH244A v.3 |
| 74LVC_LVCH244A v.3 | 20030520 | Product specification | - | 74LVC_H244A v.2 |
| 74LVC_H244A v.2 | 19980520 | Product specification | - | 74LVC244A_74LVCH244A v.1 |
| 74LVC244A_74LVCH244A v.1 | 19960906 | 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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