

74LVC132A

Quad 2-input NAND Schmitt trigger

Rev. 4 — 6 July 2020

Product data sheet

1. General description

The 74LVC132A provides four 2-input NAND gates with Schmitt trigger inputs. It is capable of transforming slowly-changing input signals into sharply defined, jitter-free output signals.

The inputs switch at different points for positive and negative-going signals. The difference between the positive voltage V_{T+} and the negative voltage V_{T-} is defined as the input hysteresis voltage V_H .

Inputs can be driven from either 3.3 V or 5 V devices. This feature allows the use of these devices as translators in mixed 3.3 V and 5 V environment.

2. Features and benefits

- Wide supply voltage range from 1.2 V to 3.6 V
- 5 V tolerant inputs for interfacing with 5 V logic
- CMOS low-power consumption
- Direct interface with TTL levels
- Unlimited input rise and fall times
- Inputs accept voltages up to 5.5 V
- Complies with JEDEC standard JESD8-C/JESD36 (2.7 V to 3.6 V)
- ESD protection:
 - HBM JESD22-A114F exceeds 2000 V
 - MM JESD22-A115-B exceeds 200 V
 - CDM JESD22-C101E exceeds 1000 V
- Specified from -40 °C to +85 °C and -40 °C to +125 °C

3. Applications

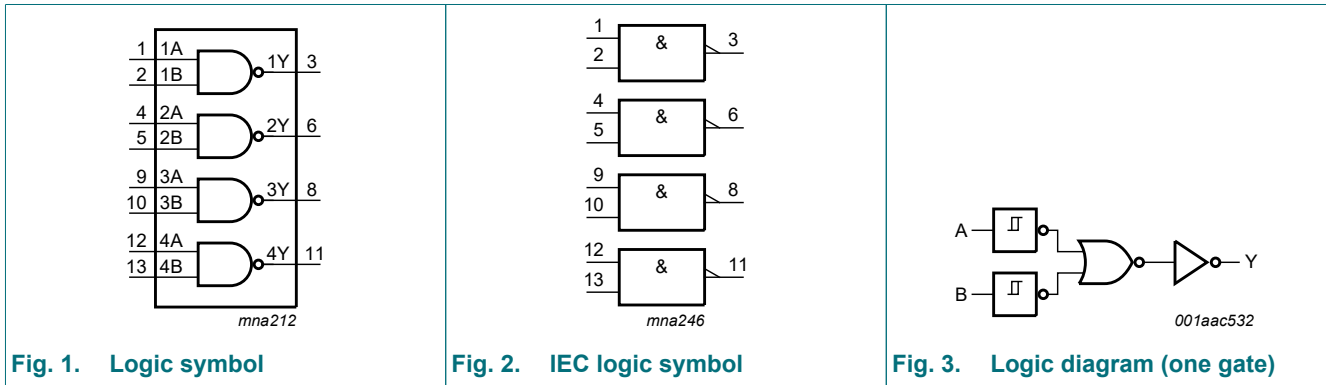
- Wave and pulse shapers for highly noisy environments
- Astable multivibrator
- Monostable multivibrator.

4. Ordering information

Table 1. Ordering information

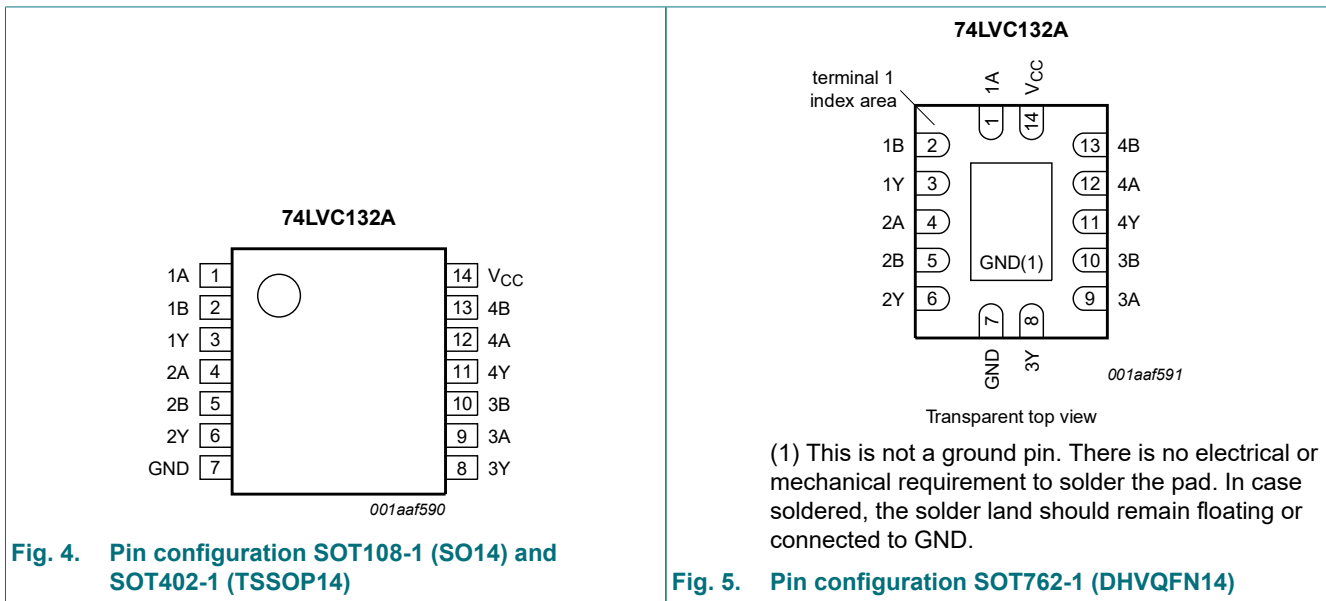
| Type number | Package | | | Version |
|-------------|-------------------|----------|--|----------|
| | Temperature range | Name | Description | |
| 74LVC132AD | -40 °C to +125 °C | SO14 | plastic small outline package; 14 leads; body width 3.9 mm | SOT108-1 |
| 74LVC132APW | -40 °C to +125 °C | TSSOP14 | plastic thin shrink small outline package; 14 leads; body width 4.4 mm | SOT402-1 |
| 74LVC132ABQ | -40 °C to +125 °C | DHVQFN14 | plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 × 3 × 0.85 mm | SOT762-1 |

5. Functional diagram



6. Pinning information

6.1. Pinning



6.2. Pin description

Table 2. Pin description

| Symbol | Pin | Description |
|-----------------|--------------|----------------|
| 1A, 2A, 3A, 4A | 1, 4, 9, 12 | data input |
| 1B, 2B, 3B, 4B | 2, 5, 10, 13 | data input |
| 1Y, 2Y, 3Y, 4Y | 3, 6, 8, 11 | data output |
| GND | 7 | ground (0 V) |
| V _{CC} | 14 | supply voltage |

7. Functional description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level.

| Input | | Output |
|-------|----|--------|
| nA | nB | nY |
| L | L | H |
| L | H | H |
| H | L | H |
| H | H | L |

8. 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 |
| V_I | input voltage | [1] | -0.5 | +6.5 | V |
| V_O | output voltage | [2] | -0.5 | $V_{CC} + 0.5$ | V |
| I_{IK} | input clamping current | $V_I < 0$ V | -50 | - | mA |
| I_{OK} | output clamping current | $V_O > V_{CC}$ or $V_O < 0$ V | - | ± 50 | mA |
| 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 SOT108-1 (SO14) package: P_{tot} derates linearly with 10.1 mW/K above 100 °C.

For SOT402-1 (TSSOP14) package: P_{tot} derates linearly with 7.3 mW/K above 81 °C.

For SOT762-1 (DHVQFN14) package: P_{tot} derates linearly with 9.6 mW/K above 98 °C.

9. 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 | | 0 | - | V_{CC} | V |
| T_{amb} | ambient temperature | | -40 | - | +125 | °C |

10. 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 |
|--|---------------------------|---|------------------------|---------|------|------|
| T_{amb} = -40 °C to +85 °C | | | | | | |
| V _{OH} | HIGH-level output voltage | V _I = V _{T+} or V _{T-} | | | | |
| | | I _O = -100 μA; V _{CC} = 1.65 V to 3.6 V | V _{CC} - 0.2 | - | - | V |
| | | I _O = -4 mA; V _{CC} = 1.65 V | V _{CC} - 0.45 | - | - | V |
| | | I _O = -8 mA; V _{CC} = 2.3 V | V _{CC} - 0.5 | - | - | V |
| | | I _O = -12 mA; V _{CC} = 2.7 V | V _{CC} - 0.5 | - | - | V |
| | | I _O = -18 mA; V _{CC} = 3.0 V | V _{CC} - 0.6 | - | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{T+} or V _{T-} | | | | |
| | | I _O = 100 μA; V _{CC} = 1.65 V to 3.6 V | - | - | 0.2 | V |
| | | I _O = 4 mA; V _{CC} = 1.65 V | - | - | 0.45 | V |
| | | I _O = 8 mA; V _{CC} = 2.3 V | - | - | 0.6 | V |
| | | I _O = 12 mA; V _{CC} = 2.7 V | - | - | 0.4 | V |
| | | I _O = 24 mA; V _{CC} = 3.0 V | - | - | 0.55 | V |
| I _I | input leakage current | V _{CC} = 3.6 V; V _I = 5.5 V or GND | - | ±0.1 | ±5 | μA |
| I _{CC} | supply current | V _{CC} = 3.6 V; V _I = V _{CC} or GND; I _O = 0 A | - | 0.1 | 10 | 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 | μA |
| C _I | input capacitance | V _{CC} = 0 V to 3.6 V; V _I = GND to V _{CC} | - | 4.0 | - | pF |
| T_{amb} = -40 °C to +125 °C | | | | | | |
| V _{OH} | HIGH-level output voltage | V _I = V _{T+} or V _{T-} | | | | |
| | | I _O = -100 μA; V _{CC} = 1.65 V to 3.6 V | V _{CC} - 0.3 | - | - | V |
| | | I _O = -4 mA; V _{CC} = 1.65 V | V _{CC} - 0.6 | - | - | V |
| | | I _O = -8 mA; V _{CC} = 2.3 V | V _{CC} - 0.65 | - | - | V |
| | | I _O = -12 mA; V _{CC} = 2.7 V | V _{CC} - 0.65 | - | - | V |
| | | I _O = -18 mA; V _{CC} = 3.0 V | V _{CC} - 0.75 | - | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{T+} or V _{T-} | | | | |
| | | I _O = 100 μA; V _{CC} = 1.65 V to 3.6 V | - | - | 0.3 | V |
| | | I _O = 4 mA; V _{CC} = 1.65 V | - | - | 0.65 | V |
| | | I _O = 8 mA; V _{CC} = 2.3 V | - | - | 0.8 | V |
| | | I _O = 12 mA; V _{CC} = 2.7 V | - | - | 0.6 | V |
| | | I _O = 24 mA; V _{CC} = 3.0 V | - | - | 0.8 | V |
| I _I | input leakage current | V _{CC} = 3.6 V; V _I = 5.5 V or GND | - | - | ±20 | μA |
| I _{CC} | supply current | V _{CC} = 3.6 V; V _I = V _{CC} or GND; I _O = 0 A | - | - | 40 | 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 | mA |

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

11. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). For test circuit see Fig. 7.

| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | -40 °C to +125 °C | | Unit |
|-------------|-------------------------------|---|------------------|---------|------|-------------------|------|------|
| | | | Min | Typ [1] | Max | Min | Max | |
| t_{pd} | propagation delay | nA, nB to nY; see Fig. 6 [2] | | | | | | |
| | | $V_{CC} = 1.2\text{ V}$ | - | 18.0 | - | - | - | ns |
| | | $V_{CC} = 1.65\text{ V to }1.95\text{ V}$ | 2.0 | 7.2 | 12.8 | 2.0 | 16.0 | ns |
| | | $V_{CC} = 2.3\text{ V to }2.7\text{ V}$ | 1.5 | 4.0 | 7.6 | 1.5 | 9.6 | ns |
| | | $V_{CC} = 2.7\text{ V}$ | 1.5 | 3.8 | 7.6 | 1.5 | 9.6 | ns |
| | | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$ | 1.5 | 3.4 | 6.4 | 1.5 | 8.0 | ns |
| $t_{sk(o)}$ | output skew time | [3] | - | - | 1.0 | - | 1.5 | ns |
| C_{PD} | power dissipation capacitance | per buffer; $V_I = \text{GND to } V_{CC}$ [4] | | | | | | |
| | | $V_{CC} = 1.65\text{ V to }1.95\text{ V}$ | - | 10.5 | - | - | - | pF |
| | | $V_{CC} = 2.3\text{ V to }2.7\text{ V}$ | - | 10.8 | - | - | - | 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} .

[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;

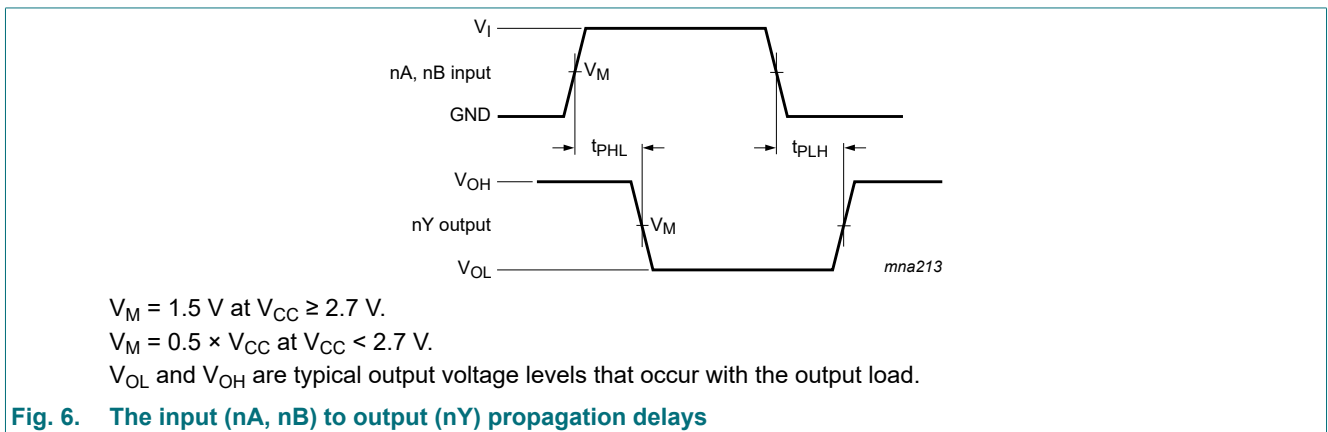
N = number of inputs switching;

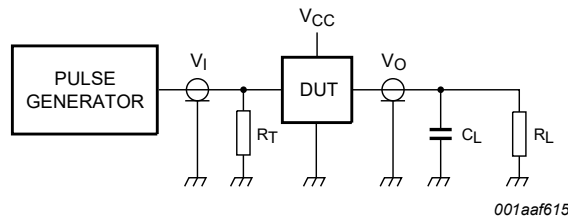
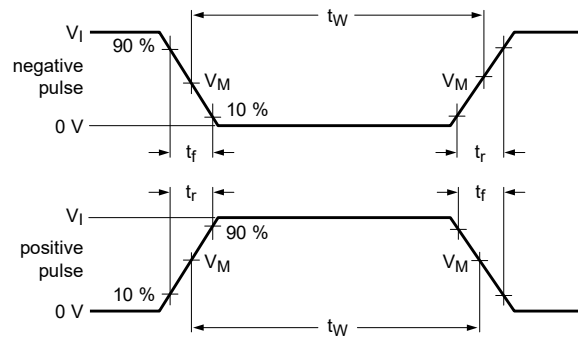
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

$\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

11.1. Waveforms and test circuit





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Test data is given in [Table 8](#). 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.

Fig. 7. Test circuit for measuring switching times

Table 8. Test data

| Supply voltage | Input | | Load | |
|------------------|----------|---------------|-------|--------------|
| | V_I | t_r, t_f | C_L | R_L |
| 1.2 V | V_{CC} | ≤ 2 ns | 30 pF | 1 k Ω |
| 1.65 V to 1.95 V | V_{CC} | ≤ 2 ns | 30 pF | 1 k Ω |
| 2.3 V to 2.7 V | V_{CC} | ≤ 2 ns | 30 pF | 500 Ω |
| 2.7 V | 2.7 V | ≤ 2.5 ns | 50 pF | 500 Ω |
| 3.0 V to 3.6 V | 2.7 V | ≤ 2.5 ns | 50 pF | 500 Ω |

12. Transfer characteristics

Table 9. Transfer characteristics

Voltages are referenced to GND (ground = 0 V); see Fig. 8.

| Symbol | Parameter | Conditions | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|-----------------|---|--------------------------|------------------|------|-------------------|------|------|
| | | | Min | Max | Min | Max | |
| V _{T+} | positive-going threshold voltage | V _{CC} = 1.2 V | 0.2 | 1.0 | 0.2 | 1.0 | V |
| | | V _{CC} = 1.65 V | 0.4 | 1.3 | 0.4 | 1.3 | V |
| | | V _{CC} = 1.95 V | 0.6 | 1.5 | 0.6 | 1.5 | V |
| | | V _{CC} = 2.3 V | 0.8 | 1.7 | 0.8 | 1.7 | V |
| | | V _{CC} = 2.5 V | 0.9 | 1.7 | 0.9 | 1.7 | V |
| | | V _{CC} = 2.7 V | 1.1 | 2 | 1.1 | 2 | V |
| | | V _{CC} = 3 V | 1.2 | 2 | 1.2 | 2 | V |
| | | V _{CC} = 3.6 V | 1.2 | 2 | 1.2 | 2 | V |
| V _{T-} | negative-going threshold voltage | V _{CC} = 1.2 V | 0.12 | 0.75 | 0.12 | 0.75 | V |
| | | V _{CC} = 1.65 V | 0.15 | 0.85 | 0.15 | 0.85 | V |
| | | V _{CC} = 1.95 V | 0.25 | 0.95 | 0.25 | 0.95 | V |
| | | V _{CC} = 2.3 V | 0.4 | 1.1 | 0.4 | 1.1 | V |
| | | V _{CC} = 2.5 V | 0.4 | 1.2 | 0.4 | 1.2 | V |
| | | V _{CC} = 2.7 V | 0.8 | 1.4 | 0.8 | 1.4 | V |
| | | V _{CC} = 3 V | 0.8 | 1.5 | 0.8 | 1.5 | V |
| | | V _{CC} = 3.6 V | 0.8 | 1.5 | 0.8 | 1.5 | V |
| V _H | hysteresis voltage (V _{T+} - V _{T-}) | V _{CC} = 1.2 V | 0.1 | 1.0 | 0.1 | 1.0 | V |
| | | V _{CC} = 1.65 V | 0.2 | 1.15 | 0.2 | 1.15 | V |
| | | V _{CC} = 1.95 V | 0.2 | 1.25 | 0.2 | 1.25 | V |
| | | V _{CC} = 2.3 V | 0.3 | 1.3 | 0.3 | 1.3 | V |
| | | V _{CC} = 2.5 V | 0.3 | 1.3 | 0.3 | 1.3 | V |
| | | V _{CC} = 2.7 V | 0.3 | 1.1 | 0.3 | 1.1 | V |
| | | V _{CC} = 3 V | 0.3 | 1.2 | 0.3 | 1.2 | V |
| | | V _{CC} = 3.6 V | [1] | 0.3 | 1.2 | 0.3 | 1.2 |

[1] Typical transfer characteristic is displayed in Fig. 9.

12.1. Waveforms transfer characteristics

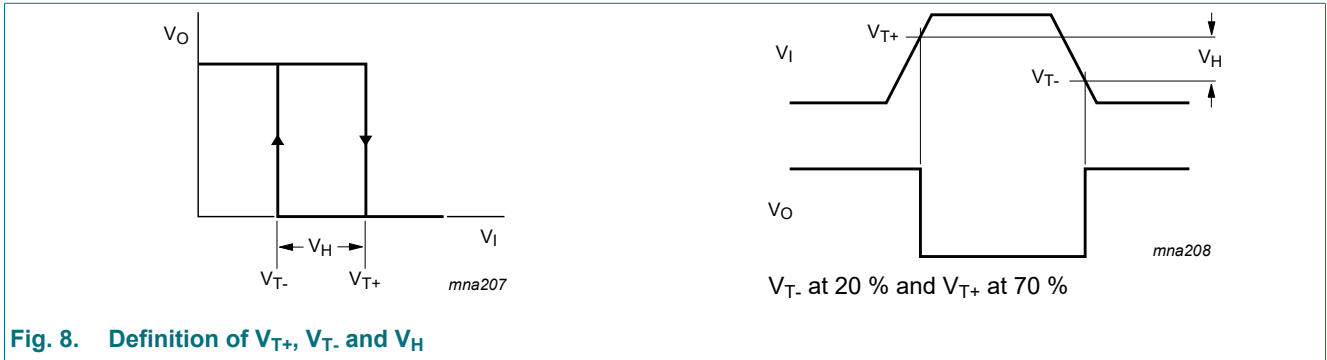


Fig. 8. Definition of V_{T+} , V_{T-} and V_H

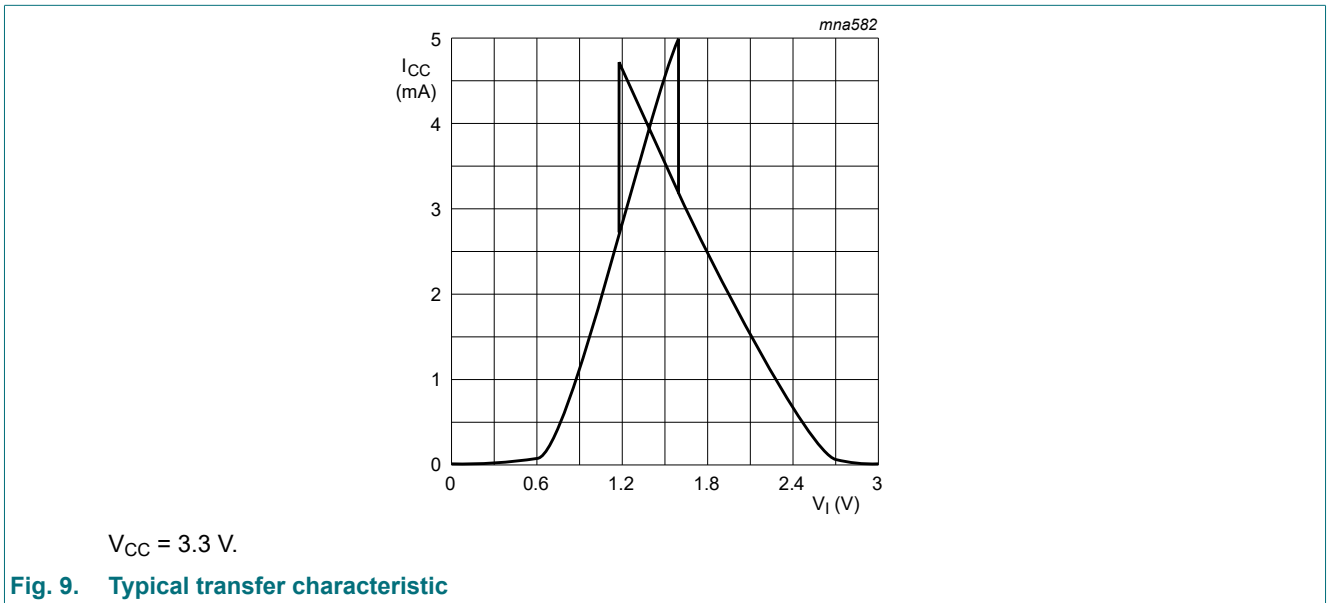


Fig. 9. Typical transfer characteristic

13. Package outline

SO14: plastic small outline package; 14 leads; body width 3.9 mm

SOT108-1



Fig. 10. Package outline SOT108-1 (SO14)

TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm

SOT402-1



Fig. 11. Package outline SOT402-1 (TSSOP14)

DHVQFN14: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 x 3 x 0.85 mm

SOT762-1



Fig. 12. Package outline SOT762-1 (DHVQFN14)

14. 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 |

15. Revision history

Table 11. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------|--|--------------------|---------------|---------------|
| 74LVC132A v.4 | 20200706 | Product data sheet | - | 74LVC132A v.3 |
| 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. Table 4: Derating values for P_{tot} total power dissipation updated. Fig. 12: Package outline drawing SOT762-1 (DHVQFN14) updated. | | | |
| 74LVC132A v.3 | 20111207 | Product data sheet | - | 74LVC132A v.2 |
| Modifications: | <ul style="list-style-type: none"> Legal pages updated. | | | |
| 74LVC132A v.2 | 20110829 | Product data sheet | - | 74LVC132A v.1 |
| 74LVC132A v.1 | 20061215 | Product data sheet | - | - |

16. 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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