# 74ALVC14

## Hex inverting Schmitt trigger

Rev. 6.1 — 14 July 2023 Product data sheet

## 1. General description

The 74ALVC14 is a hex inverter with Schmitt-trigger inputs.

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

## 2. Features and benefits

- Wide supply voltage range from 1.65 V to 3.6 V
- CMOS low power dissipation
- Overvoltage tolerant inputs to 3.6 V
- Direct interface with TTL levels
- $I_{OFF}$ circuitry provides partial Power-down mode operation
- Latch-up performance exceeds 250 mA per JESD78 Class II.A
- Complies with JEDEC standard:
  - JESD8-7 (1.65 V to 1.95 V)
  - JESD8-5 (2.3 V to 2.7 V)
  - JESD8C/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
- Multiple package options
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

## 3. Ordering information

**Table 1. Ordering information**

| Type number | Package | | | |
|---|---|---|---|---|
| | Temperature range | Name | Description | Version |
| 74ALVC14D | -40 °C to +125 °C | SO14 | plastic small outline package; 14 leads; body width 3.9 mm | SOT108-1 |
| 74ALVC14PW | -40 °C to +125 °C | TSSOP14 | plastic thin shrink small outline package; 14 leads; body width 4.4 mm | SOT402-1 |
| 74ALVC14BQ | -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 |

## 4. Functional diagram

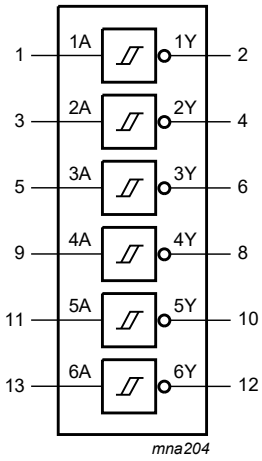



Fig. 1. Logic symbol

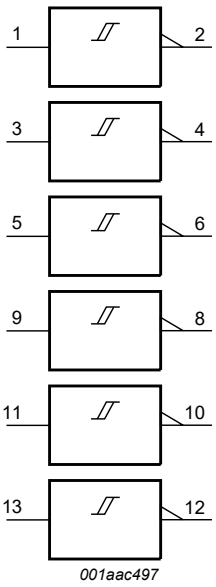



Fig. 2. IEC logic symbol

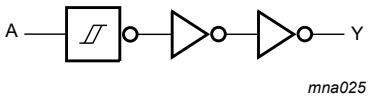
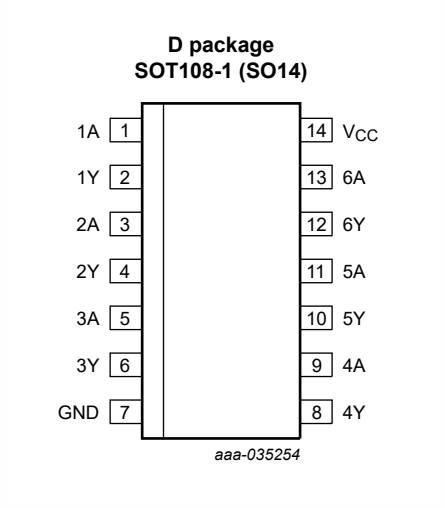
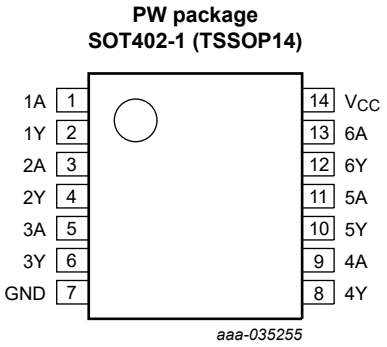


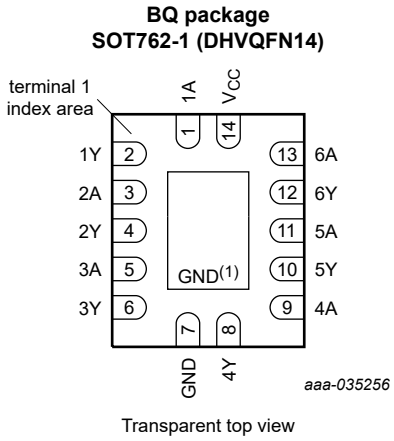

Fig. 3. Logic diagram (one Schmitt trigger)

# 5. Pinning information

## 5.1. Pinning




Transparent top view

(1) This is not a ground pin. There is no electrical or mechanical requirement to solder the pad. In case soldered, the solder land should remain floating or connected to GND.

### 5.2. Pin description

**Table 2. Pin description**

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

## 6. Functional description

**Table 3. Function table**

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

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

## 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 | +4.6 | V |
| $V_O$ | output voltage | active mode [1] | -0.5 | $V_{CC}$ + 0.5 | V |
| | | power-down mode; $V_{CC}$ = 0 V | -0.5 | +4.6 | 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 |
| $I_{O(sink/source)}$ | output sink or source 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 [2] | - | 500 | mW |

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

# 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | supply voltage | | 1.65 | 3.6 | V |
| $V_I$ | input voltage | | 0 | 3.6 | V |
| $V_O$ | output voltage | $V_{CC}$ = 1.65 to 3.6 V | 0 | $V_{CC}$ | V |
| | | power-down mode; $V_{CC}$ = 0 V | 0 | 3.6 | V |
| $T_{amb}$ | ambient temperature | in free air | -40 | +125 | °C |

# 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 | |
| $V_{OH}$ | 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 | - | - | $V_{CC}$ - 0.2 | - | V |
| | | $I_O$ = -6 mA; $V_{CC}$ = 1.65 V | 1.25 | 1.51 | - | 1.25 | - | V |
| | | $I_O$ = -12 mA; $V_{CC}$ = 2.3 V | 1.8 | 2.10 | - | 1.8 | - | V |
| | | $I_O$ = -18 mA; $V_{CC}$ = 2.3 V | 1.7 | 2.01 | - | 1.7 | - | V |
| | | $I_O$ = -12 mA; $V_{CC}$ = 2.7 V; | 2.2 | 2.53 | - | 2.2 | - | V |
| | | $I_O$ = -18 mA; $V_{CC}$ = 3.0 V | 2.4 | 2.76 | - | 2.4 | - | V |
| | | $I_O$ = -24 mA; $V_{CC}$ = 3.0 V | 2.2 | 2.68 | - | 2.2 | - | 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 | - | 0.2 | V |
| | | $I_O$ = 6 mA; $V_{CC}$ = 1.65 V | - | 0.11 | 0.3 | - | 0.3 | V |
| | | $I_O$ = 12 mA; $V_{CC}$ = 2.3 V | - | 0.17 | 0.4 | - | 0.4 | V |
| | | $I_O$ = 18 mA; $V_{CC}$ = 2.3 V | - | 0.25 | 0.6 | - | 0.6 | V |
| | | $I_O$ = 12 mA; $V_{CC}$ = 2.7 V; | - | 0.16 | 0.4 | - | 0.4 | V |
| | | $I_O$ = 18 mA; $V_{CC}$ = 3.0 V | - | 0.23 | 0.4 | - | 0.45 | V |
| | | $I_O$ = 24 mA; $V_{CC}$ = 3.0 V | - | 0.30 | 0.55 | - | 0.55 | V |
| $I_I$ | input leakage current | $V_{CC}$ = 3.6 V; $V_I$ = 3.6 V or GND | - | ±0.1 | ±5 | - | ±20 | µA |
| $I_{OFF}$ | power-off leakage current | $V_{CC}$ = 0 V; $V_I$ or $V_O$ = 3.6 V | - | ±0.1 | ±10 | - | ±80 | µA |
| $I_{CC}$ | supply current | $V_{CC}$ = 3.6 V; $V_I$ = $V_{CC}$ or GND; $I_O$ = 0 A | - | 0.2 | 10 | - | 80 | µA |
| $\Delta I_{CC}$ | additional supply current | per input pin; $V_{CC}$ = 3.0 V to 3.6 V; $V_I$ = $V_{CC}$ - 0.6 V; $I_O$ = 0 A | - | 5 | 750 | - | 750 | µA |
| $C_I$ | input capacitance | | - | 3.5 | - | - | - | pF |

[1] Typical values are measured at $T_{amb}$ = 25 °C.

# 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

*Voltages are referenced to GND (ground = 0 V). For test circuit, see Fig. 5.*

| 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 to nY; see Fig. 4 [2] | | | | | | |
| | | $V_{CC}$ = 1.65 V to 1.95 V | 1.0 | 2.9 | 4.4 | 1.0 | 5.1 | ns |
| | | $V_{CC}$ = 2.3 V to 2.7 V | 1.0 | 2.2 | 3.7 | 1.0 | 4.3 | ns |
| | | $V_{CC}$ = 2.7 V | 1.0 | 2.8 | 3.9 | 1.0 | 4.5 | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V | 1.0 | 2.4 | 3.4 | 1.0 | 3.9 | ns |
| $C_{PD}$ | power dissipation capacitance | per inverter; $V_I$ = GND to $V_{CC}$; $V_{CC}$ = 3.3 V [3] | - | 25 | - | - | - | pF |

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

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

[3] $C_{PD}$ 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;

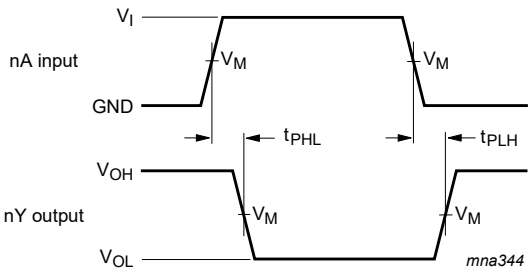
$C_L$ = output load capacitance in pF;

$V_{CC}$ = supply voltage in V;

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



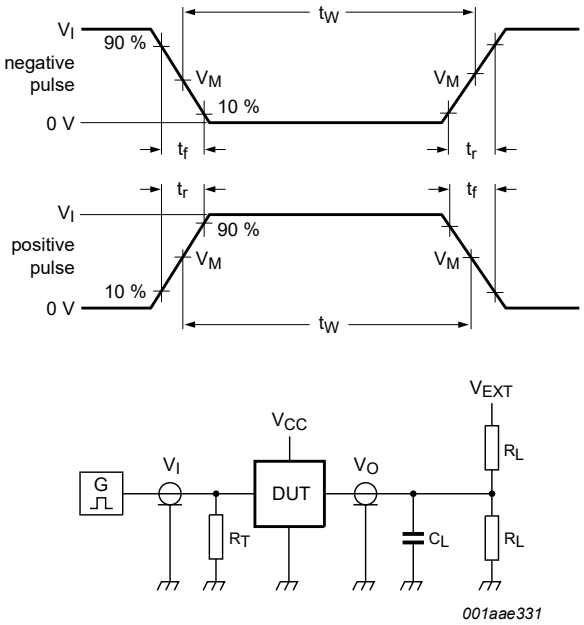

Measurement points are given in Table 8.

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

**Fig. 4. Input (nA) to output (nY) propagation delays**

**Table 8. Measurement points**

| Supply voltage | Input | | Output |
|---|---|---|---|
| $V_{CC}$ | $V_I$ | $V_M$ | $V_M$ |
| 1.65 V to 1.95 V | $V_{CC}$ | 0.5 × $V_{CC}$ | 0.5 × $V_{CC}$ |
| 2.3 V to 2.7 V | $V_{CC}$ | 0.5 × $V_{CC}$ | 0.5 × $V_{CC}$ |
| 2.7 V | 2.7 V | 1.5 V | 1.5 V |
| 3.0 V to 3.6 V | 2.7 V | 1.5 V | 1.5 V |




Test data is given in Table 9.

Definitions test circuit:

$R_T$ = Termination resistance should be equal to output impedance $Z_o$ of the pulse generator;

$C_L$ = Load capacitance including jig and probe capacitance;

$R_L$ = Load resistance;

$V_{EXT}$ = Test voltage for switching times.

**Fig. 5. Test circuit for measuring switching times**

**Table 9. Test data**

| Supply voltage | Input | | Load | | $V_{EXT}$ |
|---|---|---|---|---|---|
| $V_{CC}$ | $V_I$ | $t_r$, $t_f$ | $C_L$ | $R_L$ | $t_{PLH}$, $t_{PHL}$ |
| 1.65 V to 1.95 V | $V_{CC}$ | ≤ 2.0 ns | 30 pF | 1 kΩ | open |
| 2.3 V to 2.7 V | $V_{CC}$ | ≤ 2.0 ns | 30 pF | 500 Ω | open |
| 2.7 V | 2.7 V | ≤ 2.5 ns | 50 pF | 500 Ω | open |
| 3.0 V to 3.6 V | 2.7 V | ≤ 2.5 ns | 50 pF | 500 Ω | open |

# 11. Transfer characteristics

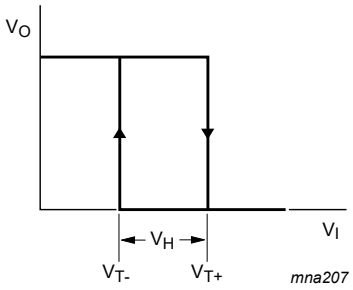
**Table 10. Transfer characteristics**

*Voltages are referenced to GND (ground = 0 V); see Fig. 6.*

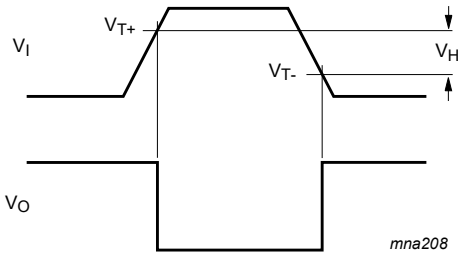
| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | -40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ[1] | Max | Min | Max | |
| $V_{T+}$ | positive-going threshold voltage | $V_{CC}$ = 1.65 V | 0.7 | 0.98 | 1.24 | 0.7 | 1.24 | V |
| | | $V_{CC}$ = 1.95 V | 0.75 | 1.12 | 1.46 | 0.75 | 1.46 | V |
| | | $V_{CC}$ = 2.3 V | 0.9 | 1.27 | 1.7 | 0.9 | 1.7 | V |
| | | $V_{CC}$ = 2.7 V | 1.0 | 1.43 | 2.0 | 1.0 | 2.0 | V |
| | | $V_{CC}$ = 3.0 V [2] | 1.1 | 1.56 | 2.0 | 1.1 | 2.0 | V |
| | | $V_{CC}$ = 3.6 V | 1.1 | 1.81 | 2.0 | 1.1 | 2.0 | V |
| $V_{T-}$ | negative-going threshold voltage | $V_{CC}$ = 1.65 V | 0.41 | 0.64 | 0.9 | 0.41 | 0.9 | V |
| | | $V_{CC}$ = 1.95 V | 0.49 | 0.76 | 1.1 | 0.49 | 1.1 | V |
| | | $V_{CC}$ = 2.3 V | 0.6 | 0.90 | 1.3 | 0.6 | 1.3 | V |
| | | $V_{CC}$ = 2.7 V | 0.7 | 1.06 | 1.4 | 0.7 | 1.4 | V |
| | | $V_{CC}$ = 3.0 V [2] | 0.8 | 1.19 | 1.5 | 0.8 | 1.5 | V |
| | | $V_{CC}$ = 3.6 V | 0.8 | 1.42 | 1.7 | 0.8 | 1.7 | V |
| $V_H$ | hysteresis voltage | $V_{CC}$ = 1.65 V | 0.25 | 0.34 | 0.62 | 0.25 | 0.62 | V |
| | | $V_{CC}$ = 1.95 V | 0.25 | 0.36 | 0.62 | 0.25 | 0.62 | V |
| | | $V_{CC}$ = 2.3 V | 0.3 | 0.36 | 1.0 | 0.3 | 1.0 | V |
| | | $V_{CC}$ = 2.7 V | 0.3 | 0.38 | 1.1 | 0.3 | 1.1 | V |
| | | $V_{CC}$ = 3.0 V [2] | 0.3 | 0.37 | 1.2 | 0.3 | 1.2 | V |
| | | $V_{CC}$ = 3.6 V | 0.3 | 0.40 | 1.2 | 0.3 | 1.2 | V |

[1] All typical values are measured at $T_{amb}$ = 25 °C.
[2] The typical transfer characteristic is displayed in Fig. 7.

## 11.1. Transfer characteristics waveforms



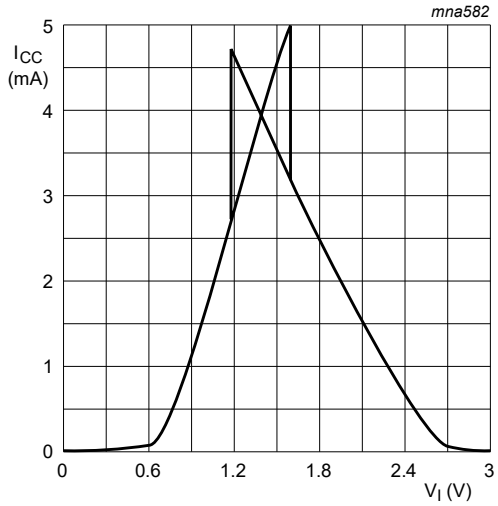

a. Transfer characteristics




$V_{T-}$ at 20 % and $V_{T+}$ at 70 %

b. Transfer characteristics definitions

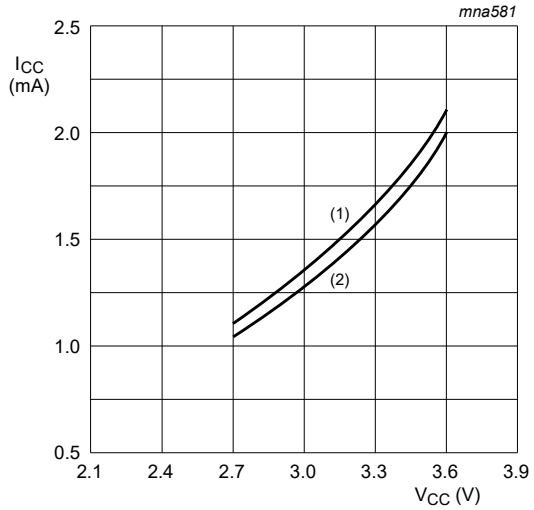
**Fig. 6. Definition of $V_{T+}$, $V_{T-}$ and $V_H$**




$V_{CC}$ = 3.0 V

**Fig. 7. Typical transfer characteristic**

## 12. Application information



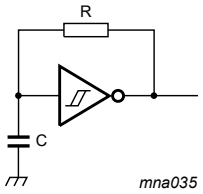

(1) Positive-going edge.

(2) Negative going-edge.

Linear change of $V_I$ between 0.8 V to 2.0 V.

All values given are typical unless otherwise specified.

**Fig. 8. Average supply current as a function of supply voltage**

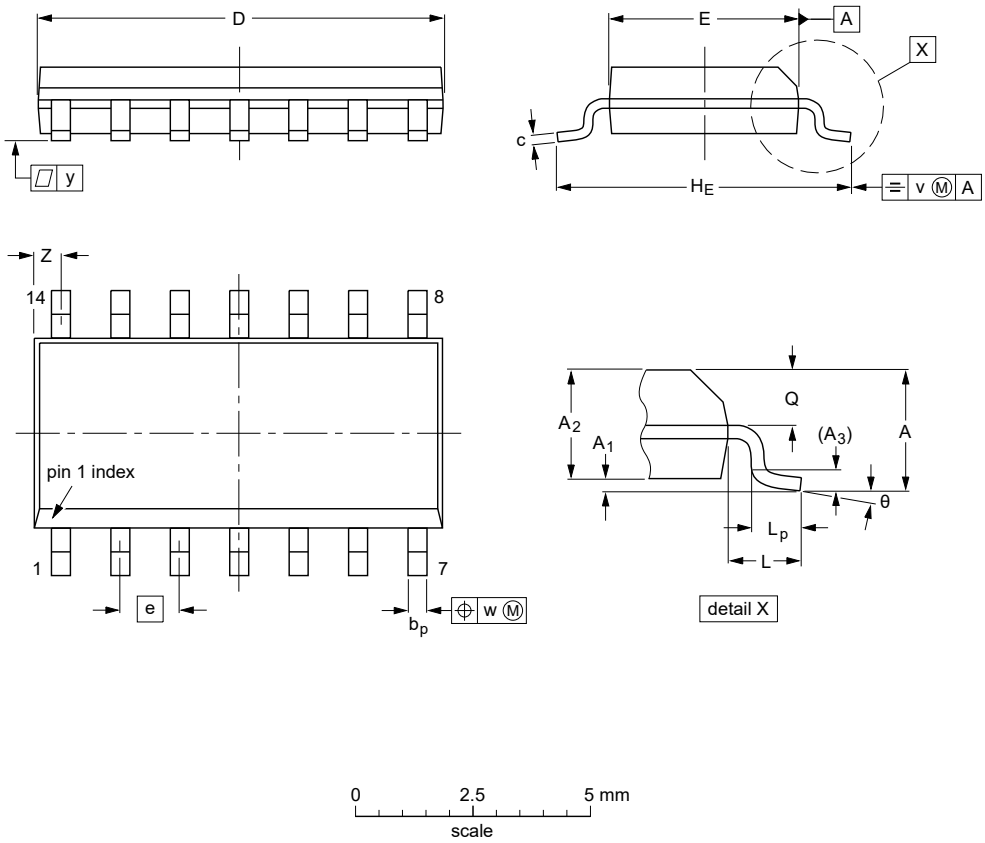



$f = \frac{1}{T} \approx \frac{1}{0.8 \times RC}$ at $V_{CC}$ = 3.0 V.

**Fig. 9. Relaxation oscillator**

## 13. Package outline

**SO14: plastic small outline package; 14 leads; body width 3.9 mm** **SOT108-1**




**DIMENSIONS (inch dimensions are derived from the original mm dimensions)**

| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | $D^{(1)}$ | $E^{(1)}$ | e | $H_E$ | L | $L_p$ | Q | v | w | y | $Z^{(1)}$ | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.75 | 0.25<br>0.10 | 1.45<br>1.25 | 0.25 | 0.49<br>0.36 | 0.25<br>0.19 | 8.75<br>8.55 | 4.0<br>3.8 | 1.27 | 6.2<br>5.8 | 1.05 | 1.0<br>0.4 | 0.7<br>0.6 | 0.25 | 0.25 | 0.1 | 0.7<br>0.3 | $8^o$<br>$0^o$ |
| inches | 0.069 | 0.010<br>0.004 | 0.057<br>0.049 | 0.01 | 0.019<br>0.014 | 0.0100<br>0.0075 | 0.35<br>0.34 | 0.16<br>0.15 | 0.05 | 0.244<br>0.228 | 0.041 | 0.039<br>0.016 | 0.028<br>0.024 | 0.01 | 0.01 | 0.004 | 0.028<br>0.012 | |

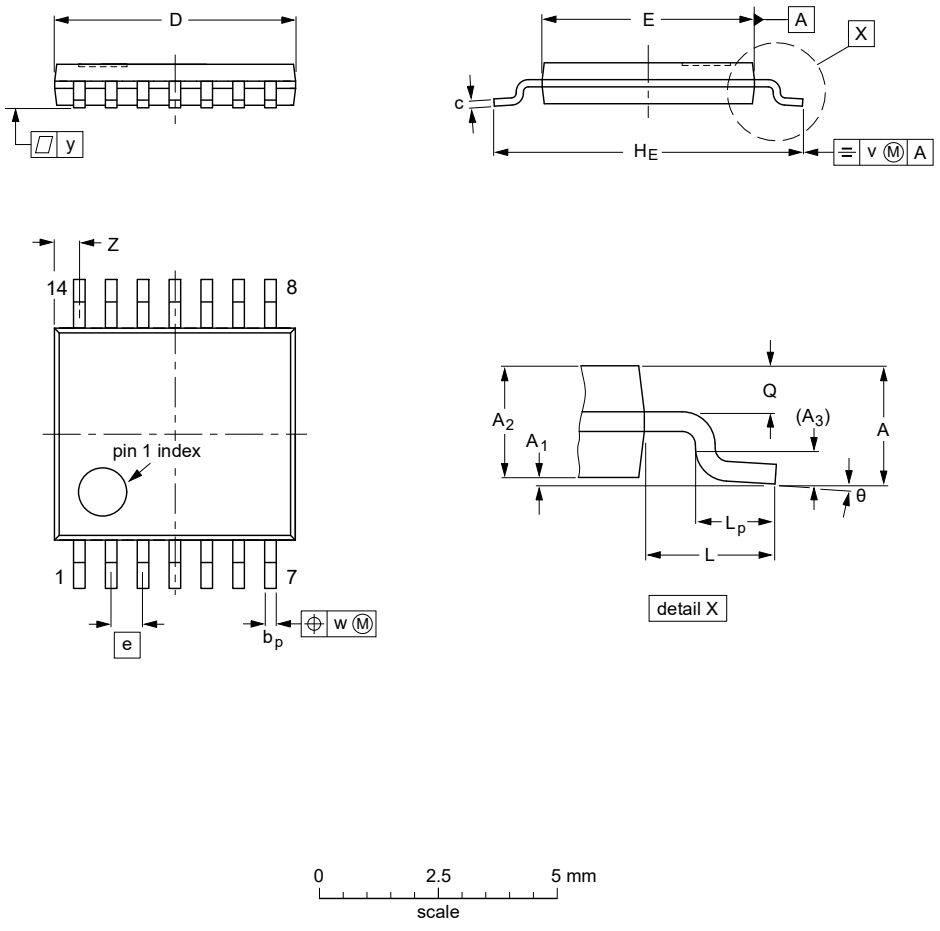
**Note**

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT108-1 | 076E06 | MS-012 | | | | ~~99-12-27~~<br>03-02-19 |

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

**TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm** **SOT402-1**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | D (1) | E (2) | e | $H_E$ | L | $L_p$ | Q | v | w | y | Z (1) | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.1 | 0.15<br>0.05 | 0.95<br>0.80 | 0.25 | 0.30<br>0.19 | 0.2<br>0.1 | 5.1<br>4.9 | 4.5<br>4.3 | 0.65 | 6.6<br>6.2 | 1 | 0.75<br>0.50 | 0.4<br>0.3 | 0.2 | 0.13 | 0.1 | 0.72<br>0.38 | 8°<br>0° |

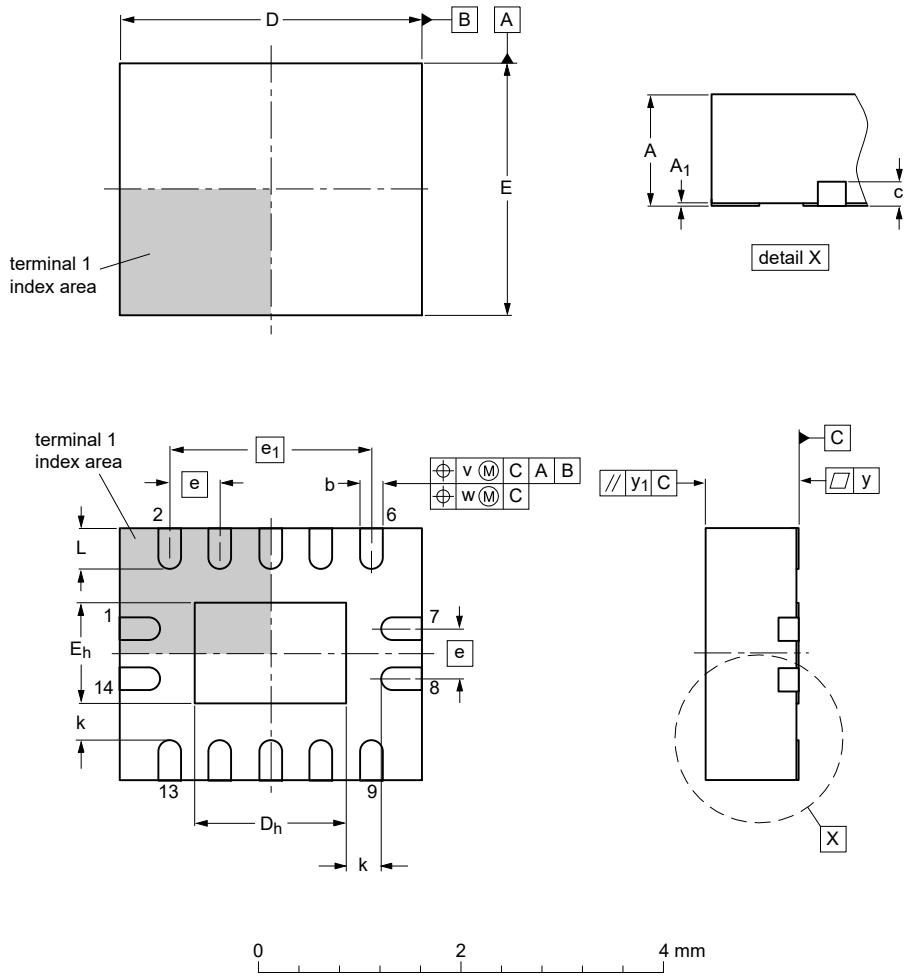
**Notes**

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.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT402-1 | | MO-153 | | | | ~~99-12-27~~<br>03-02-18 |

**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**




Dimensions (mm are the original dimensions)

| Unit | | $A^{(1)}$ | $A_1$ | b | c | $D^{(1)}$ | $D_h$ | $E^{(1)}$ | $E_h$ | e | $e_1$ | k | L | v | w | y | $y_1$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | max | 1 | 0.05 | 0.30 | | 3.1 | 1.65 | 2.6 | 1.15 | | | | 0.5 | | | | |
| mm | nom | | 0.02 | 0.25 | 0.2 | 3.0 | 1.50 | 2.5 | 1.00 | 0.5 | 2 | | 0.4 | 0.1 | 0.05 | 0.05 | 0.1 |
| | min | | 0.00 | 0.18 | | 2.9 | 1.35 | 2.4 | 0.85 | | | 0.2 | 0.3 | | | | |

Note

1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

*sot762-1_po*

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT762-1 | | MO-241 | | | | ~~15-04-10~~ 15-05-05 |

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

## 14. Abbreviations

**Table 11. 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 |

## 15. Revision history

**Table 12. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| 74ALVC14 v.6.1 | 20230714 | Product data sheet | - | 74ALVC14 v.5 |
| Modifications: | • Section 2 updated; ESD specification updated according to the latest JEDEC standard.<br>• Specifications added for $T_{amb}$ = -40 °C to +125 °C. | | | |
| 74ALVC14 v.5 | 20210430 | Product data sheet | - | 74ALVC14 v.4 |
| Modifications: | • Section 1 updated.<br>• Section 2: Reference to JESD36 removed.<br>• Section 7: Derating values for $P_{tot}$ total power dissipation have been updated. | | | |
| 74ALVC14 v.4 | 20180814 | Product data sheet | - | 74ALVC14 v.3 |
| Modifications: | • The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.<br>• Legal texts have been adapted to the new company name where appropriate. | | | |
| 74ALVC14 v.3 | 20050215 | Product data sheet | - | 74ALVC14 v.2 |
| Modifications: | • The format of this data sheet is redesigned to comply with the current presentation and information standard of Philips Semiconductors.<br>• General text updates. | | | |
| 74ALVC14 v.2 | 20030514 | Product specification | - | 74ALVC14 v.1 |
| 74ALVC14 v.1 | 20030203 | Product specification | - | - |

# 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. |
| 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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