# 74LV07AT
## Hex buffer with open-drain outputs

**Rev. 1 — 19 December 2016**                                **Product data sheet**

## 1.  General description

The 74LV07AT is a hex buffer with open-drain outputs. The outputs are open-drain and can be connected to other open-drain outputs to implement active-LOW wired-OR or active-HIGH wired-AND functions.

Designed to operate over a $V_{CC}$ range from 4.5 V to 5.5 V, the inputs are TTL compatible, which allows the device to be used to translate from 3.3 V to 5 V.

Schmitt-trigger action at all inputs makes the circuit tolerant of slower input rise and fall times.

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.
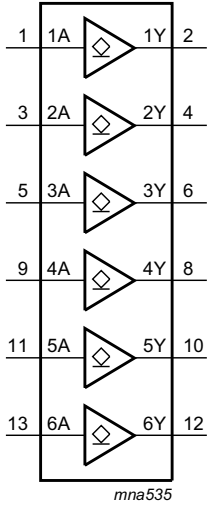
## 2.  Features and benefits

- Direct interface with TTL levels
- Supply voltage range from 4.5 V to 5.5 V
- Typical $t_{PZL}$ of 3.5 ns at 5 V
- Typical $V_{OL(p)}$ < 0.8 V at $V_{CC}$ = 5 V, $T_{amb}$ = 25 °C
- Supports mixed-mode voltage operation on all ports
- $I_{OFF}$ circuitry provides partial Power-down mode operation
- Latch-up performance exceeds 250 mA per JESD 78 Class II
- ESD protection:
    - HBM ANSI/ESDA/JEDEC JS-001 Class 2 exceeds 3 kV
    - MM JESD22-A115-A exceeds 150 V
    - CDM JESD22-C101E exceeds 2 kV
- Specified from −40 °C to +85 °C and from −40 °C to +125 °C

nexperia

## 3. Ordering information
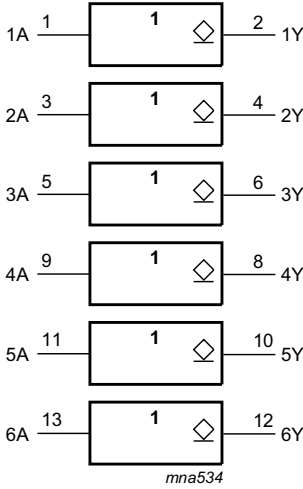
**Table 1.     Ordering information**

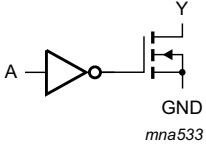| Type number | Package | | | |
|---|---|---|---|---|
| | Temperature range | Name | Description | Version |
| 74LV07ATPW | −40 °C to +125 °C | TSSOP14 | plastic thin shrink small outline package; 14 leads; body width 4.4 mm | SOT402-1 |

## 4. Functional diagram



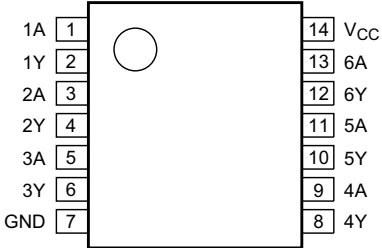**Fig 1.     Logic symbol**



**Fig 2.     IEC logic symbol**



**Fig 3.     Logic diagram for one gate**

## 5. Pinning information

### 5.1 Pinning



**Fig 4.     Pin configuration TSSOP14**

74LV07AT

All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

**Product data sheet** **Rev. 1 — 19 December 2016** 2 of 12

### 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 selection** [1]

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

[1] H = HIGH voltage level; L = LOW voltage level; Z = high-impedance OFF-state

## 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 | +7.0 | V |
| $V_I$ | input voltage | | [1] | −0.5 | +7.0 | V |
| $V_O$ | output voltage | output LOW state, power-down or 3-state mode | [2] | −0.5 | +7.0 | V |
| $I_{IK}$ | input clamping current | $V_I < 0$ V | | −20 | - | mA |
| $I_{OK}$ | output clamping current | $V_O < 0$ V | | −50 | - | mA |
| $I_O$ | output current | $V_O = 0$ V to $V_{CC}$ | | - | ±35 | mA |
| $I_{CC}$ | supply current | | | - | 70 | mA |
| $I_{GND}$ | ground current | | | −70 | - | 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 TSSOP14 packages: above 75 °C the value of $P_{tot}$ derates linearly at 7 mW/K.

74LV07AT All information provided in this document is subject to legal disclaimers.

**Product data sheet** Rev. 1 — 19 December 2016 3 of 12

# 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

*Voltages are referenced to GND (ground = 0 V).*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | supply voltage | | 4.5 | 5.0 | 5.5 | V |
| $V_I$ | input voltage | | 0 | - | 5.5 | V |
| $V_O$ | output voltage | output LOW state, power-down or 3-state mode | 0 | - | 5.5 | V |
| $T_{amb}$ | ambient temperature | | −40 | +25 | +125 | °C |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC}$ = 5.0 V ± 0.5 V | - | - | 20 | ns/V |

# 9. Static characteristics

**Table 6. Static characteristics**

*Voltages are referenced to GND (ground = 0 V).*

| Symbol | Parameter | Conditions | 25 °C | | | −40 °C to +85 °C | | −40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| $V_{IH}$ | HIGH-level input voltage | $V_{CC}$ = 4.5 V to 5.5 V | 2 | - | - | 2 | - | 2 | - | V |
| $V_{IL}$ | LOW-level input voltage | $V_{CC}$ = 4.5 V to 5.5 V | - | - | 0.8 | - | 0.8 | - | 0.8 | V |
| $V_{OL}$ | LOW-level output voltage | $V_I = V_{IH}$ or $V_{IL}$; $V_{CC}$ = 4.5 V | | | | | | | | |
| | | $I_O$ = 50 µA | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | $I_O$ = 16mA | - | - | 0.44 | - | 0.55 | - | 0.55 | V |
| $I_{OZ}$ | OFF-state output current | $V_{CC}$ = 5.5 V; $V_I = V_{IH}$ or $V_{IL}$; $V_O$ = GND to 5.5 V | - | - | ±0.25 | - | ±2.5 | - | ±2.5 | µA |
| $I_{OFF}$ | power-off leakage current | $V_I$ or $V_O$ = GND to 5.5 V; $V_{CC}$ = 0 V | - | - | 0.5 | - | 5 | - | 5 | µA |
| $I_I$ | input leakage current | $V_I = V_{CC}$ or GND; $V_{CC}$ = 0 V to 5.5 V | - | - | ±0.1 | - | ±1 | - | ±1 | µA |
| $I_{CC}$ | supply current | $V_I = V_{CC}$ or GND; $I_O$ = 0 A; $V_{CC}$ = 5.5 V | - | - | 2 | - | 20 | - | 20 | µA |
| $\Delta I_{CC}$ | additional supply current | per input pin; $V_I$ = 3.4 V; $I_O$ = 0 A; other pins at $V_{CC}$ or GND; $V_{CC}$ = 5.5 V | - | - | 1.35 | - | 1.5 | - | 1.5 | mA |

## 10. Dynamic characteristics

**Table 7.    Dynamic characteristics**
*GND = 0 V. For test circuit see Figure 6.*

| Symbol | Parameter | Conditions | 25 °C | | | −40 °C to +85 °C | | −40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ[1] | Max | Min | Max | Min | Max | |
| $t_{PZL}$ | OFF-state to LOW propagation delay | nA to nY; see Figure 5 | | | | | | | | |
| | | $V_{CC}$ = 4.5 V to 5.5 V | | | | | | | | |
| | | $C_L$ = 15 pF | - | 3.5 | 5.3 | 1 | 6.6 | 1 | 7.7 | ns |
| | | $C_L$ = 50 pF | - | 5.2 | 7.7 | 1 | 9.5 | 1 | 11 | ns |
| $t_{PLZ}$ | LOW to OFF-state propagation delay | nA to nY; see Figure 5 | | | | | | | | |
| | | $V_{CC}$ = 4.5 V to 5.5 V | | | | | | | | |
| | | $C_L$ = 15 pF | - | 3.2 | 4.3 | 1 | 5.1 | 1 | 5.7 | ns |
| | | $C_L$ = 50 pF | - | 5.4 | 7 | 1 | 8 | 1 | 8.9 | ns |
| $C_I$ | input capacitance | $V_I = V_{CC}$ or GND; $V_{CC}$ = 5 V | - | 2 | 6 | - | 6 | - | 6 | pF |
| $C_O$ | output capacitance | $V_O = V_{CC}$ or GND; $V_{CC}$ = 5 V | - | 5 | - | - | - | - | - | pF |
| $C_{PD}$ | power dissipation capacitance | per buffer;[2] $C_L$ = 50 pF; f = 10 MHz; $V_I$ = GND to $V_{CC}$ | - | 3 | - | - | - | - | - | pF |

[1]    Typical values are measured at $T_{amb}$ = 25 °C and $V_{CC}$ = 5 V.

[2]    $C_{PD}$ is used to determine the dynamic power dissipation $P_D$ (µW).

$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$ where:

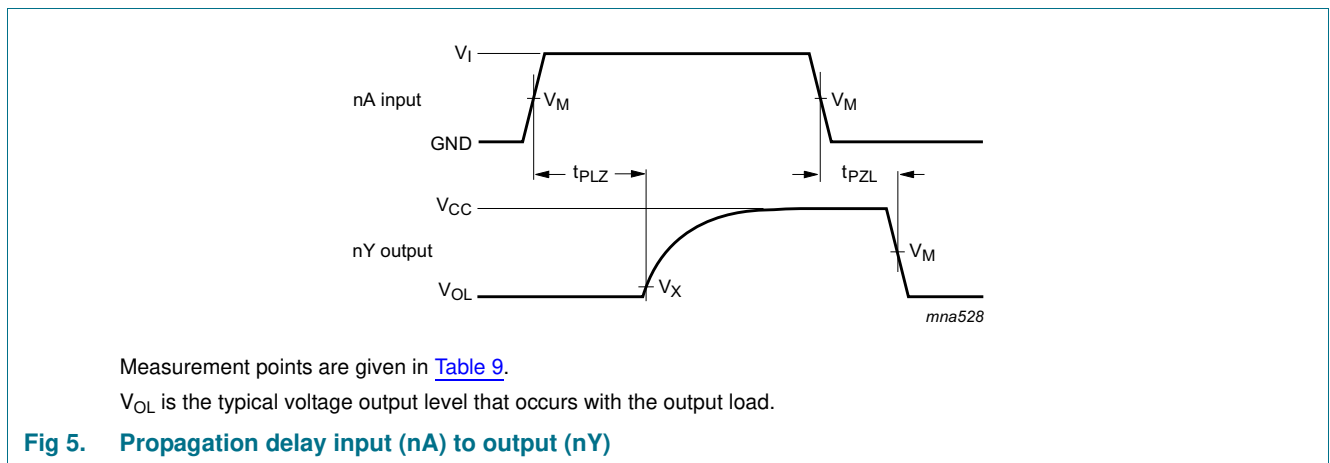$f_i$ = input frequency in MHz;

$f_o$ = output frequency in MHz;

$C_L$ = output load capacitance in pF;

$V_{CC}$ = supply voltage in Volts.

#### Table 8. Noise characteristics
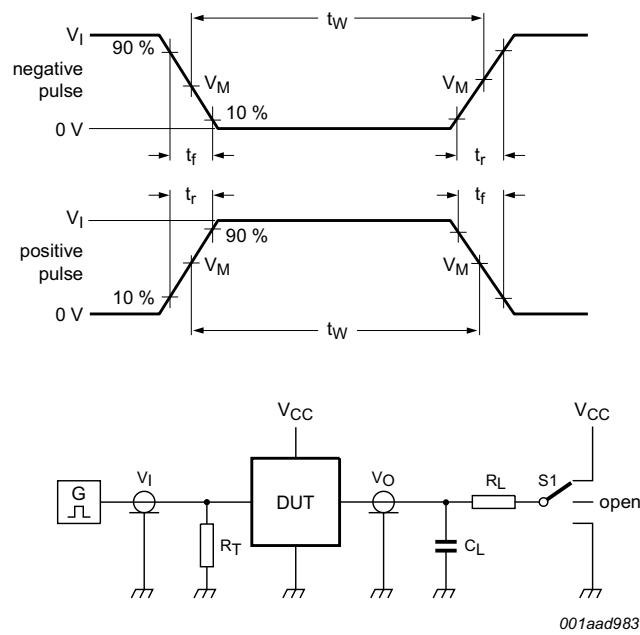*GND = 0 V. For test circuit see Figure 6.*

| Symbol | Parameter | Conditions | $T_{amb}$ = 25 °C | | | Unit |
|---|---|---|---|---|---|---|
| | | | **Min** | **Typ** | **Max** | |
| $V_{CC}$ = 5 V; $C_L$ = 50 pF | | | | | | |
| $V_{OL(p)}$ | LOW-level output voltage (peak) | | - | 0.6 | - | V |
| $V_{OL(v)}$ | LOW-level output voltage (valley) | | - | −0.4 | - | V |
| $V_{IH(AC)}$ | AC HIGH-level input voltage (dynamic) | | 2 | - | - | V |
| $V_{IL(AC)}$ | AC LOW-level input voltage (dynamic) | | - | - | 0.8 | V |

# 11. Waveforms



Measurement points are given in Table 9.

$V_{OL}$ is the typical voltage output level that occurs with the output load.

**Fig 5.** **Propagation delay input (nA) to output (nY)**

#### Table 9. Measurement points

| Input | Output | |
|---|---|---|
| $V_M$ | $V_M$ | $V_X$ |
| 1.5 V | $0.5 \times V_{CC}$ | $V_{OL}$ + 0.3 V |

74LV07AT

All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

**Product data sheet** **Rev. 1 — 19 December 2016** 6 of 12

Test data is given in Table 10.

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 resistor

S1 = Test selection switch

**Fig 6.** **Test circuit for measuring switching times**

**Table 10.** **Test data**

| Input | | Load | | S1 position |
|---|---|---|---|---|
| $V_I$ | $t_r$, $t_f$ | $C_L$ | $R_L$ | $t_{PLZ}$, $t_{PZL}$ |
| GND to 3.0 V | 3.0 ns | 15 pF, 50 pF | 1 kΩ | $V_{CC}$ |

## 12. Package outline

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 0.05 | 0.95 0.80 | 0.25 | 0.30 0.19 | 0.2 0.1 | 5.1 4.9 | 4.5 4.3 | 0.65 | 6.6 6.2 | 1 | 0.75 0.50 | 0.4 0.3 | 0.2 | 0.13 | 0.1 | 0.72 0.38 | 8° 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~~ 03-02-18 |

**Fig 7.** **Package outline SOT402-1 (TSSOP14)**

## 13. Abbreviations

**Table 11.    Abbreviations**

| Acronym | Description |
|---------|-------------|
| CDM | Charge Device Model |
| DUT | Device Under Test |
| ESD | ElectroStatic Discharge |
| HBM | Human Body Model |
| MM | Machine Model |
| TTL | Transistor-Transistor Logic |

## 14. Revision history

**Table 12.    Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|-------------|--------------|-------------------|---------------|------------|
| 74LV07AT v.1 | 20161219 | Product data sheet | - | - |

## 15. Legal information

### 15.1 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 URL http://www.nexperia.com.

### 15.2 Definitions

**Draft —** The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. Nexperia does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

**Short data sheet —** A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local Nexperia sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

**Product specification —** The information and data provided in a Product data sheet shall define the specification of the product as agreed between Nexperia and its customer, unless Nexperia and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the Nexperia product is deemed to offer functions and qualities beyond those described in the Product data sheet.

### 15.3 Disclaimers

**Limited warranty and liability —** Information in this document is believed to be accurate and reliable. However, Nexperia does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. Nexperia takes no responsibility for the content in this document if provided by an information source outside of Nexperia.

In no event shall Nexperia be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, Nexperia's aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the *Terms and conditions of commercial sale* of Nexperia.

**Right to make changes —** Nexperia reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

**Suitability for use —** Nexperia products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of a Nexperia product can reasonably be expected to result in personal injury, death or severe property or environmental damage. Nexperia and its suppliers accept no liability for inclusion and/or use of Nexperia products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

**Applications —** Applications that are described herein for any of these products are for illustrative purposes only. Nexperia makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using Nexperia products, and Nexperia accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the Nexperia product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

Nexperia does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using Nexperia products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). Nexperia does not accept any liability in this respect.

**Limiting values —** Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

**Terms and conditions of commercial sale —** Nexperia products are sold subject to the general terms and conditions of commercial sale, as published at http://www.nexperia.com/profile/terms, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. Nexperia hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of Nexperia products by customer.

**No offer to sell or license —** Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

### 15.4   Trademarks

## 16. Contact information

For more information, please visit: **http://www.nexperia.com**

For sales office addresses, please send an email to: **salesaddresses@nexperia.com**

74LV07AT

All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

**Product data sheet** **Rev. 1 — 19 December 2016** **11 of 12**

# 17. Contents