## **74LV07A**

# Hex buffer with open-drain outputs Rev. 1 — 19 December 2016

**Product data sheet** 

#### **General description** 1.

The 74LV07A 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.

Inputs are overvoltage tolerant. This feature allows the use of these devices as translators in mixed voltage environments.

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<sub>OFF</sub>. The I<sub>OFF</sub> 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 2.0 V to 5.5 V
- Maximum t<sub>PZL</sub> of 7.2 ns at 5 V
- Typical  $V_{OL(p)}$  < 0.8 V at  $V_{CC}$  = 3.3 V,  $T_{amb}$  = 25 °C
- Supports mixed-mode voltage operation on all ports
- I<sub>OFF</sub> 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



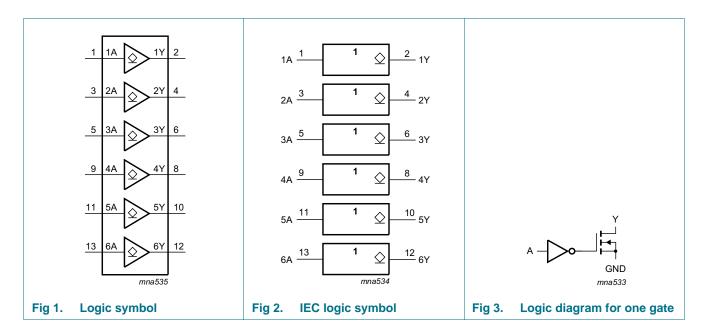
#### Hex buffer with open-drain outputs

## 3. Ordering information

Table 1. Ordering information

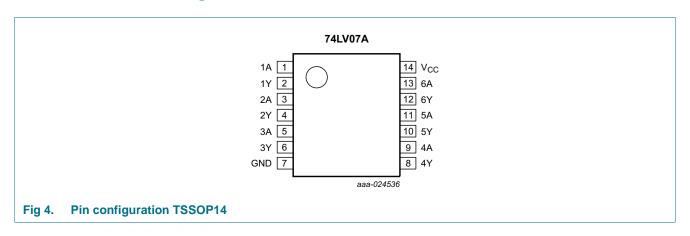
Type number	Package			
	Temperature range	Name	Description	Version
74LV07APW	-40 °C to +125 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1

## 4. Functional diagram



## 5. Pinning information

#### 5.1 Pinning



74LV07A

#### Hex buffer with open-drain outputs

## 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)
Vcc	14	supply voltage

## 6. Functional description

Table 3. Function selection [1]

Input	Output
nA	nY
L	L
Н	Z

<sup>[1]</sup> 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 <sub>CC</sub>	supply voltage			-0.5	+7.0	V
VI	input voltage		<u>[1]</u>	-0.5	+7.0	V
Vo	output voltage	output LOW state, power-down or 3-state mode	[2]	-0.5	+7.0	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < 0 V		-20	-	mA
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < 0 V		-50	-	mA
Io	output current	$V_O = 0 V \text{ to } V_{CC}$		-	±35	mA
I <sub>CC</sub>	supply current			-	70	mA
I <sub>GND</sub>	ground current			-70	-	mA
T <sub>stg</sub>	storage temperature			-65	+150	°C
P <sub>tot</sub>	total power dissipation	$T_{amb} = -40  ^{\circ}\text{C} \text{ to } +125  ^{\circ}\text{C}$	[3]	-	500	mW

<sup>[1]</sup> The minimum input voltage ratings may be exceeded if the input current ratings are observed.

<sup>[2]</sup> The output voltage ratings may be exceeded if the output current ratings are observed.

<sup>[3]</sup> For TSSOP14 packages: above 75  $^{\circ}$ C the value of P<sub>tot</sub> derates linearly at 7 mW/K.

#### Hex buffer with open-drain outputs

## 8. Recommended operating conditions

Table 5. Recommended operating conditions

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

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
V <sub>CC</sub>	supply voltage		2.0	5.0	5.5	V
VI	input voltage		0	-	5.5	V
Vo	output voltage	output LOW state, power-down or 3-state mode	0	-	5.5	V
T <sub>amb</sub>	ambient temperature		-40	+25	+125	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 2.3 V to 2.7 V	-	-	200	ns/V
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	-	100	ns/V
		V <sub>CC</sub> = 4.5 V to 5.5 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	o +85 °C	-40 °C to	Unit	
			Min	Тур	Max	Min	Max	Min	Max	
$V_{IH}$	HIGH-level	V <sub>CC</sub> = 2 V	1.5	-	-	1.5	-	1.5	-	V
	input voltage	V <sub>CC</sub> = 2.3 V to 2.7 V	0.7V <sub>CC</sub>	-	-	0.7V <sub>CC</sub>	-	0.7V <sub>CC</sub>	-	V
		V <sub>CC</sub> = 3.0 V to 3.6 V	0.7V <sub>CC</sub>	-	-	0.7V <sub>CC</sub>	-	0.7V <sub>CC</sub>	-	V
		V <sub>CC</sub> = 4.5 V to 5.5 V	0.7V <sub>CC</sub>	-	-	0.7V <sub>CC</sub>	-	0.7V <sub>CC</sub>	-	V
$V_{IL}$	LOW-level	V <sub>CC</sub> = 2 V	-	-	0.5	-	0.5	-	0.5	V
	input voltage	V <sub>CC</sub> = 2.3 V to 2.7 V	-	-	$0.3V_{CC}$	-	0.3V <sub>CC</sub>	-	0.3V <sub>CC</sub>	V
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	-	$0.3V_{CC}$	-	0.3V <sub>CC</sub>	-	0.3V <sub>CC</sub>	V
		V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	$0.3V_{CC}$	-	0.3V <sub>CC</sub>	-	0.3V <sub>CC</sub>	V
$V_{OL}$	LOW-level	$V_I = V_{IH}$ or $V_{IL}$								
	output voltage	$V_{CC} = 2.0 \text{ V to } 5.5 \text{ V};$ $I_{O} = 50  \mu\text{A}$	-	-	0.1	-	0.1	-	0.1	V
		$V_{CC} = 2.3 \text{ V}; I_{O} = 2 \text{ mA}$	-	-	0.4	-	0.4	-	0.4	V
		$V_{CC} = 3.0 \text{ V}; I_{O} = 8 \text{ mA}$	-	-	0.36	-	0.44	-	0.44	V
		$V_{CC} = 4.5 \text{ V}; I_{O} = 16 \text{ mA}$	-	-	0.44	-	0.55	-	0.55	V
I <sub>OZ</sub>	OFF-state output current	$V_{CC} = 5.5 \text{ V};$ $V_I = V_{IH} \text{ or } V_{IL};$ $V_O = \text{GND to } 5.5 \text{ V}$	-	-	±0.25	-	±2.5	-	±2.5	μА
I <sub>OFF</sub>	power-off leakage current	$V_I$ or $V_O$ = GND to 5.5 V; $V_{CC}$ = 0 V	-	-	0.5	-	5	-	5	μА
lı	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 0$ V to 5.5 V	-	-	±0.1	-	±1	-	±1	μΑ
I <sub>CC</sub>	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5 \text{ V}$	-	-	2	-	20	-	20	μΑ

#### Hex buffer with open-drain outputs

## 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 t	Unit	
			Min	Typ[1]	Max	Min	Max	Min	Max	
t <sub>PZL</sub>	OFF-state to	nA to nY; see Figure 5								
	LOW propagation	V <sub>CC</sub> = 2.3 V to 2.7 V								
	delay	C <sub>L</sub> = 15 pF	-	5.1	10.4	1	13	1	14	ns
		C <sub>L</sub> = 50 pF	-	7.5	15.2	1	18	1	19	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V								
		C <sub>L</sub> = 15 pF	-	3.9	7.1	1	8.5	1	9.5	ns
		C <sub>L</sub> = 50 pF	-	5.8	10.6	1	12	1	13	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V								
		C <sub>L</sub> = 15 pF	-	3	5.5	1	6.5	1	7.2	ns
		C <sub>L</sub> = 50 pF	-	4.6	7.5	1	8.5	1	9.2	ns
t <sub>PLZ</sub>	LOW to	nA to nY; see Figure 5								
	OFF-state	V <sub>CC</sub> = 2.3 V to 2.7 V								
	propagation delay	C <sub>L</sub> = 15 pF	-	5.6	10.4	1	13	1	14	ns
	,	C <sub>L</sub> = 50 pF	-	10.2	15.2	1	18	1	19	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V								
		C <sub>L</sub> = 15 pF	-	4.5	7.1	1	8.5	1	9.5	ns
		C <sub>L</sub> = 50 pF	-	7.9	10.6	1	12	1	13	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V								
		C <sub>L</sub> = 15 pF	-	3.6	5.5	1	6.5	1	7.2	ns
		C <sub>L</sub> = 50 pF	-	5.8	7.5	1	8.5	1	9.2	ns
Cı	input capacitance	$V_I = V_{CC}$ or GND; $V_{CC} = 3.3 \text{ V}$	-	2	6	-	6	-	6	pF
Co	output capacitance	$V_O = V_{CC}$ or GND; $V_{CC} = 3.3 \text{ V}$	-	5	-	-	-	-	-	pF
$C_{PD}$	power dissipation capacitance	per buffer; [2] $C_L = 50 \text{ pF}$ ; $f = 10 \text{ MHz}$ ; $V_I = \text{GND to } V_{CC}$								
		V <sub>CC</sub> = 3.3 V	-	2	-	-	-	-	-	pF
		V <sub>CC</sub> = 5.0 V	_	3	_	_	_	_	_	pF

<sup>[1]</sup> Typical values are measured at  $T_{amb}$  = 25 °C and  $V_{CC}$  = 2.5 V, 3.3 V, and 5 V respectively, unless otherwise specified.

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

 $f_i$  = input frequency in MHz;

 $f_o$  = output frequency in MHz;

C<sub>L</sub> = output load capacitance in pF;

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

<sup>[2]</sup>  $\;\;C_{PD}$  is used to determine the dynamic power dissipation  $P_D$  (µW).

#### Hex buffer with open-drain outputs

 Table 8.
 Noise characteristics

GND = 0 V. For test circuit see <u>Figure 6</u>.

Symbol	Parameter	Conditions	Т	T <sub>amb</sub> = 25 °C				
			Min	Тур	Max			
$V_{CC} = 3.3$	V; C <sub>L</sub> = 50 pF			,				
$V_{OL(p)}$	LOW-level output voltage (peak)		-	0.3	8.0	V		
$V_{OL(v)}$	LOW-level output voltage (valley)		-0.8	-0.1	-	V		
V <sub>IH(AC)</sub>	AC HIGH-level input voltage (dynamic)		2.31	-	-	V		
V <sub>IL(AC)</sub>	AC LOW-level input voltage (dynamic)		-	-	0.99	V		

### 11. Waveforms

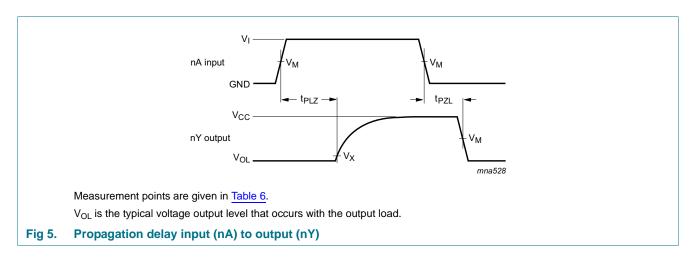
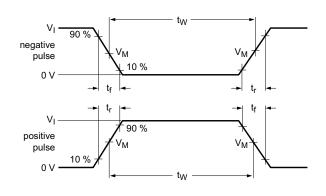
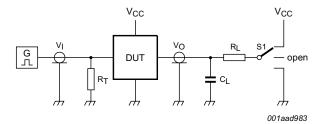


Table 9. Measurement points

Input	Output	
$V_{M}$	V <sub>M</sub>	$V_X$
$0.5 \times V_{CC}$	0.5 × V <sub>CC</sub>	V <sub>OL</sub> + 0.3 V

#### Hex buffer with open-drain outputs





Test data is given in Table 10.

Definitions test circuit:

 $R_T$  = Termination resistance should be equal to output impedance  $Z_0$  of the pulse generator

 $C_L$  = Load capacitance including jig and probe capacitance

R<sub>L</sub> = Load resistor

S1 = Test selection switch

Fig 6. Test circuit for measuring switching times

Table 10. Test data

Input	nput		Load				
$V_{l}$	t <sub>r</sub> , t <sub>f</sub>	CL	R <sub>L</sub>	t <sub>PLZ</sub> , t <sub>PZL</sub>			
GND to V <sub>CC</sub>	3.0 ns	15 pF, 50 pF	1 kΩ	V <sub>CC</sub>			

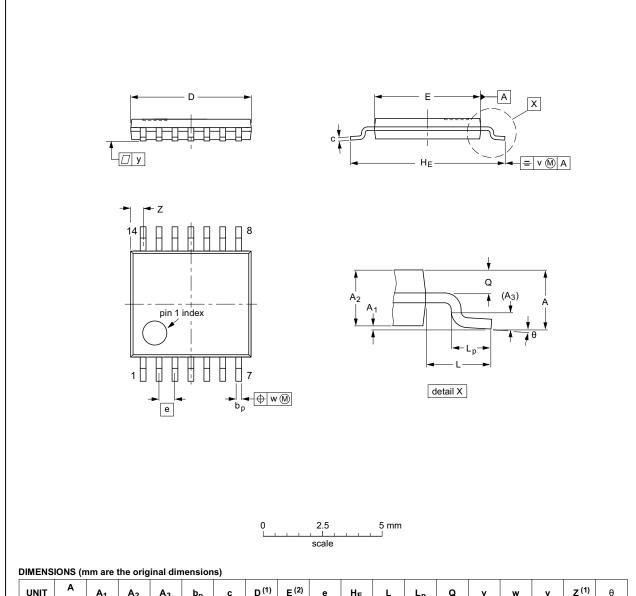
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#### Hex buffer with open-drain outputs

## 12. Package outline

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

SOT402-1



UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	<b>A</b> <sub>3</sub>	bp	С	D <sup>(1)</sup>	E (2)	е	HE	L	Lp	Q	٧	w	у	Z <sup>(1)</sup>	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.

PROJECTION ISSUE DATE
99-12-27 03-02-18

Package outline SOT402-1 (TSSOP14)

74LV07A

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#### Hex buffer with open-drain outputs

## 13. Abbreviations

#### Table 11. Abbreviations

Acronym	Description
CDM	Charge Device Model
DUT	Device Under Test
ESD	ElectroStatic Discharge
НВМ	Human Body Model
MM	Machine Model

## 14. Revision history

#### Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LV07A v.1	20161219	Product data sheet	-	-

#### Hex buffer with open-drain outputs

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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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#### Hex buffer with open-drain outputs

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#### Hex buffer with open-drain outputs

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