

# 74LVC07A-Q100

Hex buffer with open-drain outputs

Rev. 2 — 14 December 2018

Product data sheet

## 1. General description

The 74LVC07A-Q100 provides six non-inverting buffers. 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 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 applications.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

## 2. Features and benefits

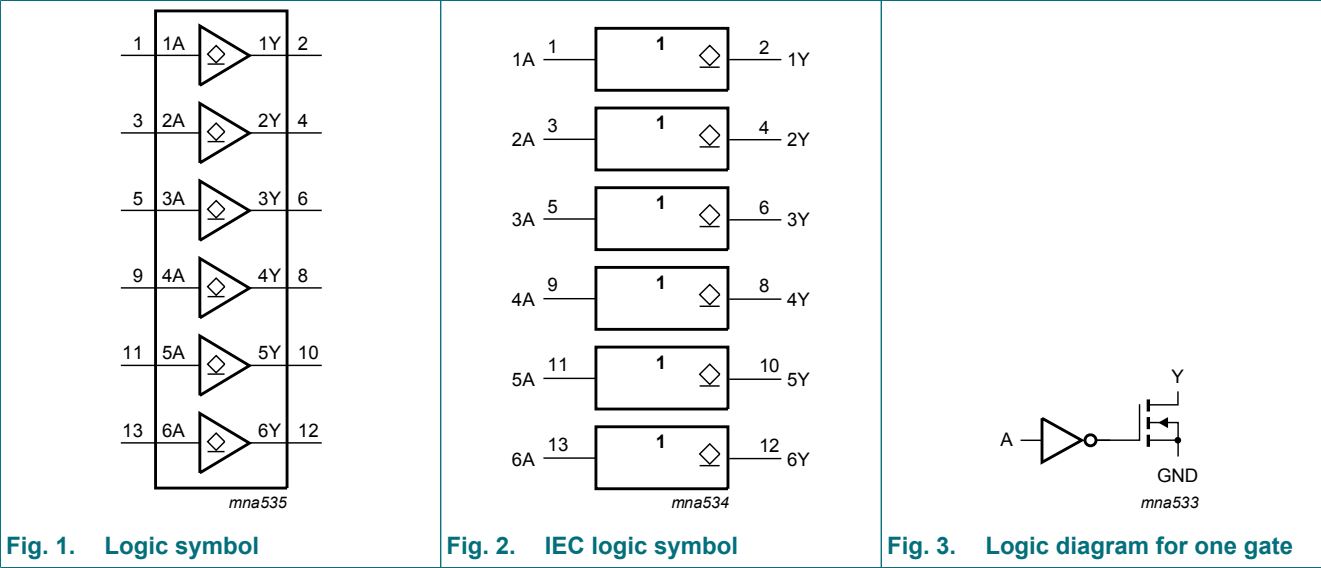
- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- 5 V tolerant inputs and outputs (open-drain) for interfacing with 5 V logic
- Wide supply voltage range from 1.2 V to 5.5 V
- CMOS low power consumption
- Direct interface with TTL levels
- Inputs accept voltages up to 5 V
- 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:
  - MIL-STD-883, method 3015 exceeds 2000 V
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V (C = 200 pF; R = 0 Ω)

## 3. Ordering information

Table 1. Ordering information

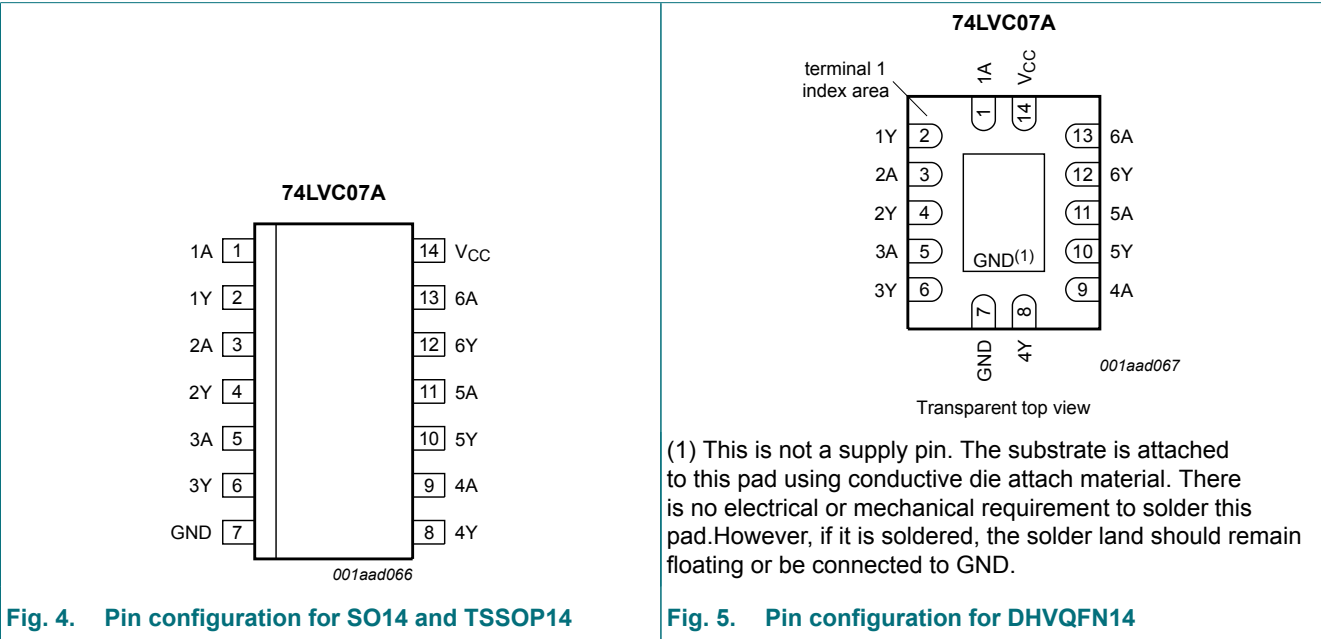
Type number	Package			
	Temperature range	Name	Description	Version
74LVC07AD-Q100	-40 °C to +125 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1
74LVC07APW-Q100	-40 °C to +125 °C	TSSOP14	plastic thin small outline package; 14 leads; body width 4.4 mm	SOT402-1
74LVC07ABQ-Q100	-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 x 3 x 0.85 mm	SOT762-1

4. Functional diagram



5. Pinning information

5.1. Pinning



## 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 <sub>CC</sub>	14	supply voltage

## 6. Functional description

Table 3. Function selection

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

Input	Output
nA	nY
L	L
H	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 <sub>CC</sub>	supply voltage		-0.5	+6.5	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < 0 V	-50	-	mA
V <sub>I</sub>	input voltage	[1]	-0.5	+6.5	V
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < 0 V	-50	-	mA
V <sub>O</sub>	output voltage	active mode [2]	-0.5	+6.5	V
		high-impedance mode [2]	-0.5	+6.5	V
I <sub>O</sub>	output current	V <sub>O</sub> = 0 V to V <sub>CC</sub>	-	50	mA
I <sub>CC</sub>	supply current		-	100	mA
I <sub>GND</sub>	ground current		-100	-	mA
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +125 °C [3]	-	500	mW
T <sub>stg</sub>	storage temperature		-65	+150	°C

[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 SO14 packages: above 70 °C derate linearly with 8 mW/K.

For TSSOP14 packages: above 60 °C derate linearly with 5.5 mW/K.

For DHVQFN14 packages: above 60 °C derates linearly with 4.5 mW/K.

## 8. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>CC</sub>	supply voltage		1.65	-	5.5	V
		functional	1.2	-	-	V
V <sub>I</sub>	input voltage		0	-	5.5	V
V <sub>O</sub>	output voltage	active mode	0	-	5.5	V
		high-impedance mode	0	-	5.5	V
T <sub>amb</sub>	ambient temperature		-40	-	+125	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 1.65 V to 2.7 V	0	-	20	ns/V
		V <sub>CC</sub> = 2.7 V to 5.5 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 <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 1.2 V	1.08	-	-	1.08	-	V
		V <sub>CC</sub> = 1.65 V to 1.95 V	0.65 × V <sub>CC</sub>	-	-	0.65 × V <sub>CC</sub>	-	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.7	-	-	1.7	-	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	2.0	-	-	2.0	-	V
		V <sub>CC</sub> = 4.5 V to 5.5 V	0.7 × V <sub>CC</sub>	-	-	0.7 × V <sub>CC</sub>	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 1.2 V	-	-	0.12	-	0.12	V
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	-	0.35 × V <sub>CC</sub>	-	0.35 × V <sub>CC</sub>	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	-	0.7	-	0.7	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	-	-	0.8	-	0.8	V
		V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	0.30 × V <sub>CC</sub>	-	0.30 × V <sub>CC</sub>	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>						
		I <sub>O</sub> = 100 μA; V <sub>CC</sub> = 1.65 V to 5.5 V	-	-	0.20	-	0.3	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V	-	-	0.45	-	0.6	V
		I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V	-	-	0.3	-	0.75	V
		I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V	-	-	0.4	-	0.6	V
		I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V	-	-	0.55	-	0.8	V
		I <sub>O</sub> = 32 mA; V <sub>CC</sub> = 4.5 V	-	-	0.55	-	0.8	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 1.65 V to 5.5 V	-	±0.1	±5	-	±20	μA
I <sub>OZ</sub>	OFF-state output current	V <sub>I</sub> = V <sub>IH</sub> ; V <sub>O</sub> = 5.5 V or GND; V <sub>CC</sub> = 1.65 V to 5.5 V	-	±0.1	±10	-	±20	μA
I <sub>OFF</sub>	power-off leakage current	V <sub>I</sub> or V <sub>O</sub> = 5.5 V; V <sub>CC</sub> = 0 V	-	±0.1	±10	-	±20	μA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	0.1	10	-	40	μA

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
$\Delta I_{CC}$	additional supply current	per input pin; $V_I = V_{CC} - 0.6 \text{ V}$ ; $I_O = 0 \text{ A}$ ; $V_{CC} = 2.7 \text{ V to } 5.5 \text{ V}$	-	5	500	-	5000	$\mu\text{A}$
$C_I$	input capacitance	$V_{CC} = 0 \text{ V to } 5.5 \text{ V}$ ; $V_I = \text{GND to } V_{CC}$	-	5.0	-	-	-	pF

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

## 10. 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	
$t_{PZL}$	OFF-state to LOW propagation delay	nA to nY; see Fig. 6						
		$V_{CC} = 1.2 \text{ V}$	-	8.0	-	-	-	ns
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	0.5	1.7	5.5	0.5	6.5	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	0.5	1.2	2.8	0.5	3.5	ns
		$V_{CC} = 2.7 \text{ V}$	0.5	1.8	3.3	0.5	4.5	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	0.5	1.2	3.6	0.5	4.5	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	0.5	1.6	2.6	0.5	3.5	ns
$t_{PLZ}$	LOW to OFF-state propagation delay	nA to nY; see Fig. 6						
		$V_{CC} = 1.2 \text{ V}$	-	10	-	-	-	ns
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	0.5	3.0	5.5	0.5	6.5	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	0.5	1.7	2.8	0.5	3.5	ns
		$V_{CC} = 2.7 \text{ V}$	0.5	2.1	3.3	0.5	4.5	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	0.5	2.5	3.6	0.5	4.5	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	0.5	1.6	2.6	0.5	3.5	ns
$C_{PD}$	power dissipation capacitance	per buffer; $V_I = \text{GND to } V_{CC}$ [2]						
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	-	6.5	-	-	-	pF
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	-	6.9	-	-	-	pF
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	-	7.2	-	-	-	pF

[1] Typical values are measured at  $T_{amb} = 25 \text{ °C}$  and  $V_{CC} = 1.2 \text{ V}$ ,  $1.8 \text{ V}$ ,  $2.5 \text{ V}$ ,  $2.7 \text{ V}$ ,  $3.3 \text{ V}$  and  $5.0 \text{ V}$  respectively.

[2]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ).

$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$  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

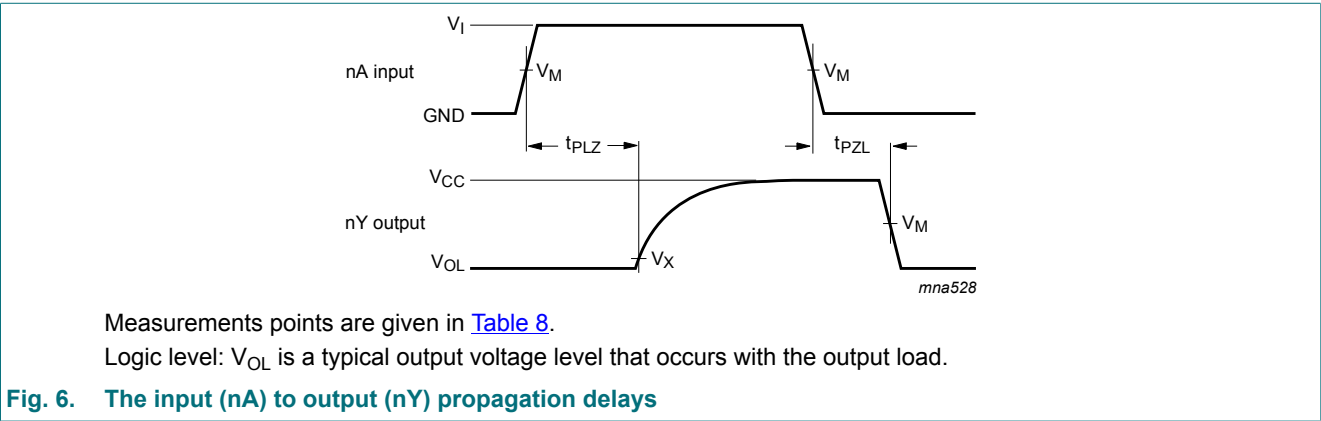
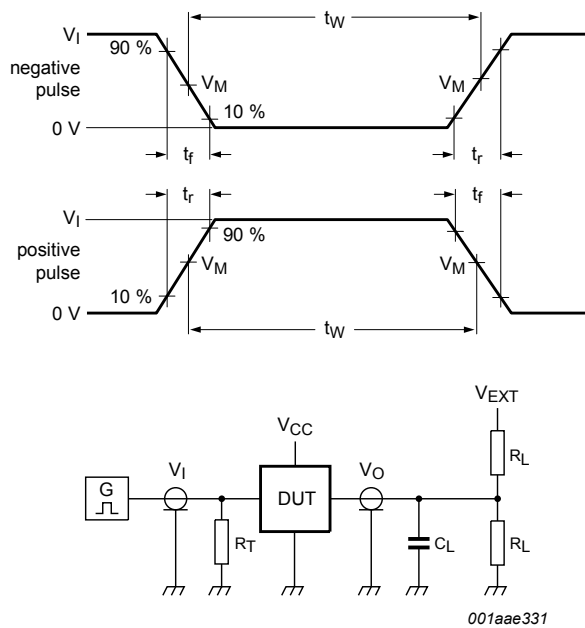


Table 8. Measurement points

Supply voltage	Input	Output
$V_{CC}$	$V_M$	$V_X$
$< 2.7\text{ V}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15\text{ V}$
$\geq 2.7\text{ V to } 3.6\text{ V}$	$1.5\text{ V}$	$V_{OL} + 0.3\text{ V}$
$\geq 4.5\text{ V to } 5.5\text{ V}$	$0.5 \times V_{CC}$	$V_{OL} + 0.3\text{ V}$



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. 7. Test circuit for measuring switching times

Table 9. Test data

Supply voltage	Input		Load		V <sub>EXT</sub>		
	V <sub>I</sub>	t <sub>r</sub> , t <sub>f</sub>	C <sub>L</sub>	R <sub>L</sub>	t <sub>PLH</sub> , t <sub>PHL</sub>	t <sub>PLZ</sub> , t <sub>PZL</sub>	t <sub>PHZ</sub> , t <sub>PZH</sub>
1.2 V	V <sub>CC</sub>	≤ 2 ns	30 pF	1 kΩ	open	2 × V <sub>CC</sub>	GND
1.65 V to 1.95 V	V <sub>CC</sub>	≤ 2 ns	30 pF	1 kΩ	open	2 × V <sub>CC</sub>	GND
2.3 V to 2.7 V	V <sub>CC</sub>	≤ 2 ns	30 pF	500 Ω	open	2 × V <sub>CC</sub>	GND
2.7 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open	2 × V <sub>CC</sub>	GND
3.0 V to 3.6 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open	2 × V <sub>CC</sub>	GND
4.5 V to 5.5 V	V <sub>CC</sub>	≤ 2.5 ns	50 pF	500 Ω	open	2 × V <sub>CC</sub>	GND

11. Package outline

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

SOT108-1

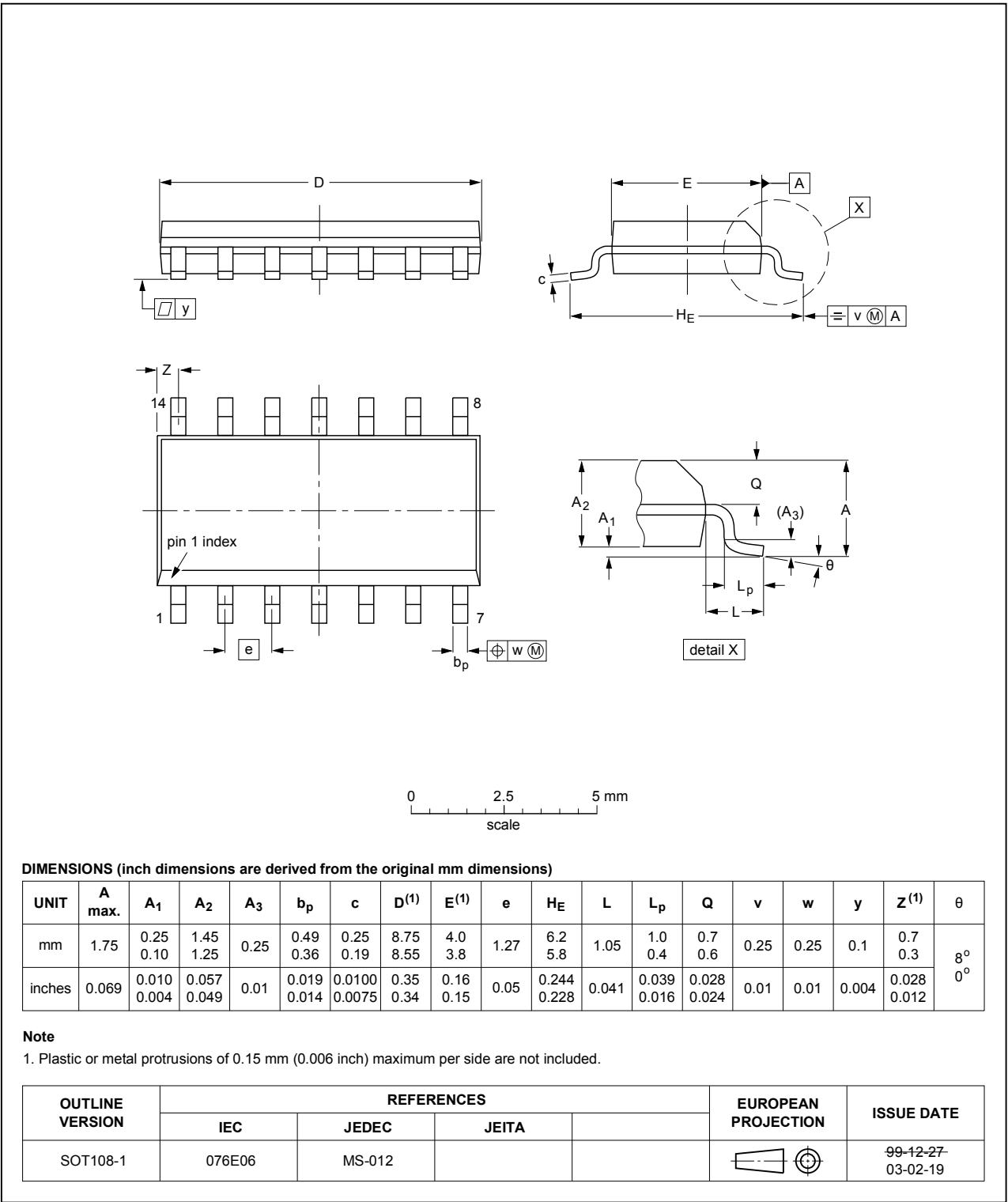
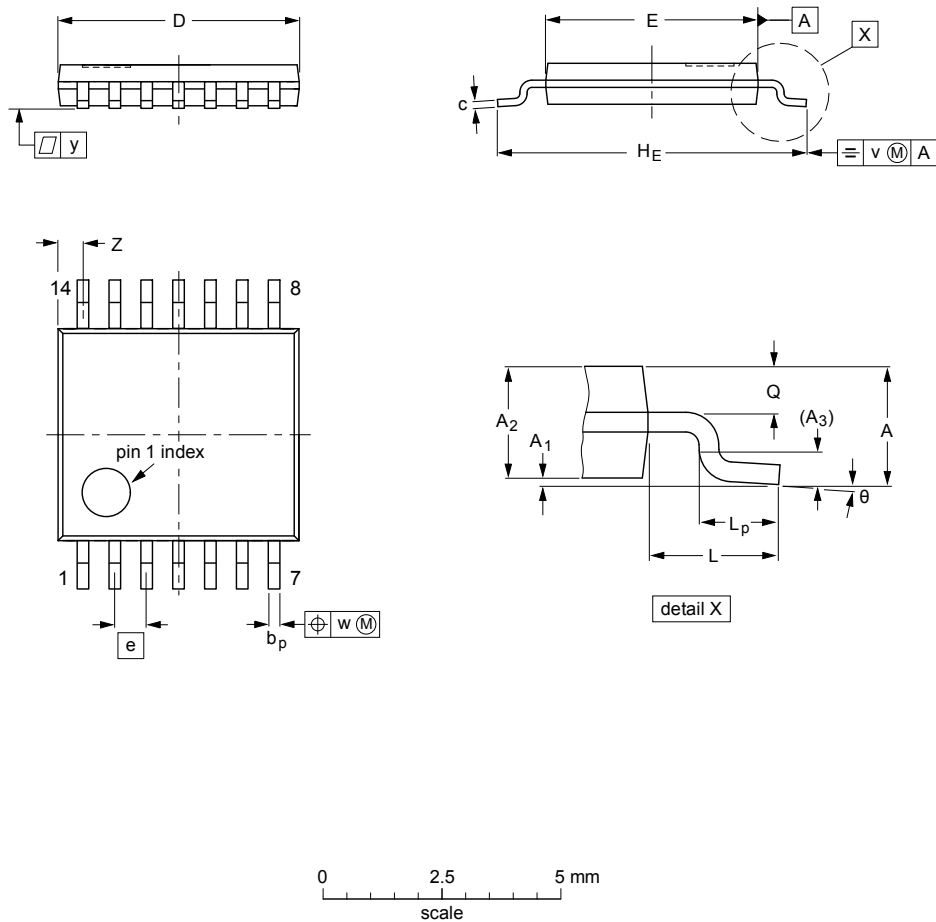


Fig. 8. Package outline SOT108-1 (SO14)



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

SOT402-1



DIMENSIONS (mm are the original dimensions)

UNIT	A <sub>max.</sub>	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(2)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	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.


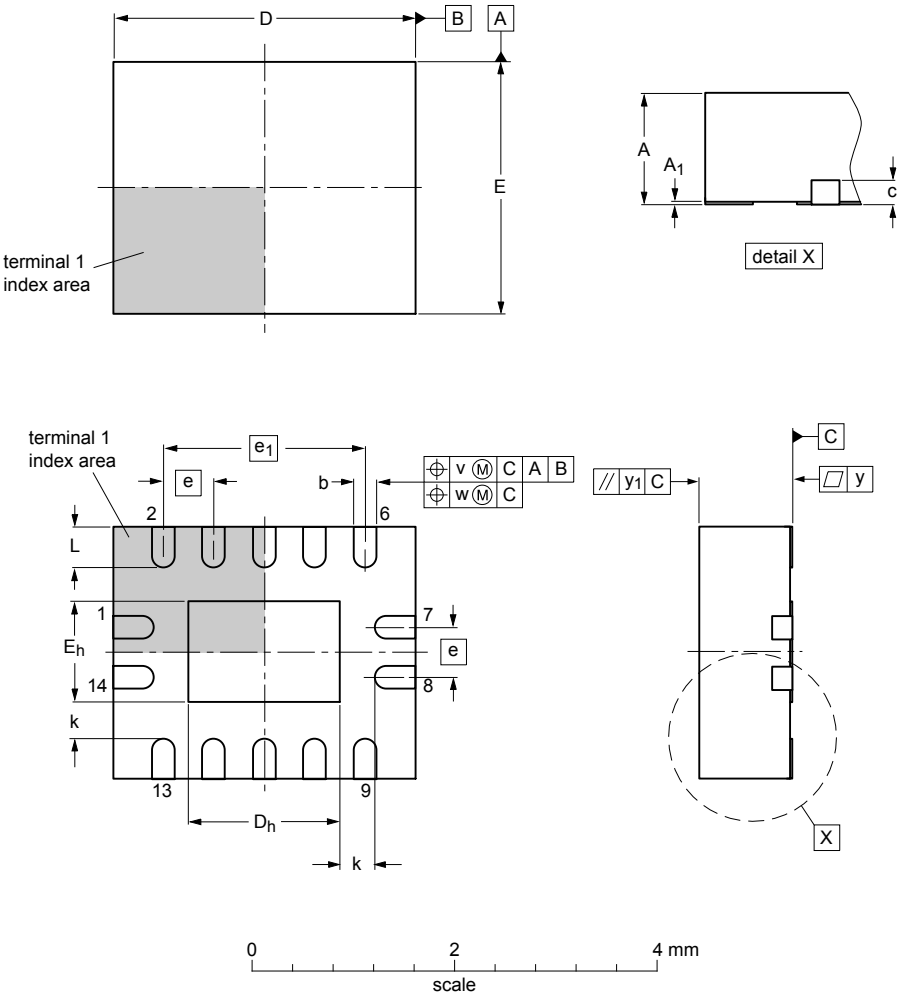
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT402-1		MO-153				99-12-27 03-02-18

Fig. 9. 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 <sup>(1)</sup>	A <sub>1</sub>	b	c	D <sup>(1)</sup>	D <sub>h</sub>	E <sup>(1)</sup>	E <sub>h</sub>	e	e <sub>1</sub>	k	L	v	w	y	y <sub>1</sub>
max	1	0.05	0.30		3.1	1.65	2.6	1.15				0.5				
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. 10. Package outline SOT762-1 (DHVQFN14)

## 12. Abbreviations

Table 10. Abbreviations

Acronym	Description
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model
MIL	Military
TTL	Transistor-Transistor Logic

## 13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC07A_Q100 v.2	20181214	Product data sheet	-	74LVC07A_Q100 v.1
Modifications:	<ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li><li>Legal texts have been adapted to the new company name where appropriate.</li><li><a href="#">Table 5</a>: Maximum output voltage (active mode) changed from <math>V_{CC}</math> to 5.5 V</li></ul>			
74LVC07A_Q100 v.1	20121001	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.
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".
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