



74LV14

Hex inverting Schmitt trigger

Rev. 10 — 23 January 2024

Product data sheet

1. General description

The 74LV14 is a low-voltage Si-gate CMOS device that is pin and function compatible with 74HC14 and 74HCT14.

The 74LV14 provides six inverting buffers with Schmitt-trigger input. 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 .

2. Features and benefits

- Wide supply voltage range from 1.0 V to 5.5 V
- CMOS low power dissipation
- Optimized for low voltage applications: 1.0 V to 3.6 V
- Accepts TTL input levels between $V_{CC} = 2.7$ V and $V_{CC} = 3.6$ V
- Typical output ground bounce < 0.8 V at $V_{CC} = 3.3$ V and $T_{amb} = 25$ °C
- Typical HIGH-level output voltage (V_{OH}) undershoot: > 2 V at $V_{CC} = 3.3$ V and $T_{amb} = 25$ °C
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Complies with JEDEC standards:
 - JESD8-7 (1.65 V to 1.95 V)
 - JESD8-5 (2.3 V to 2.7 V)
 - JESD8C (2.7 V to 3.6 V)
 - JESD36 (4.5 V to 5.5 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. Applications

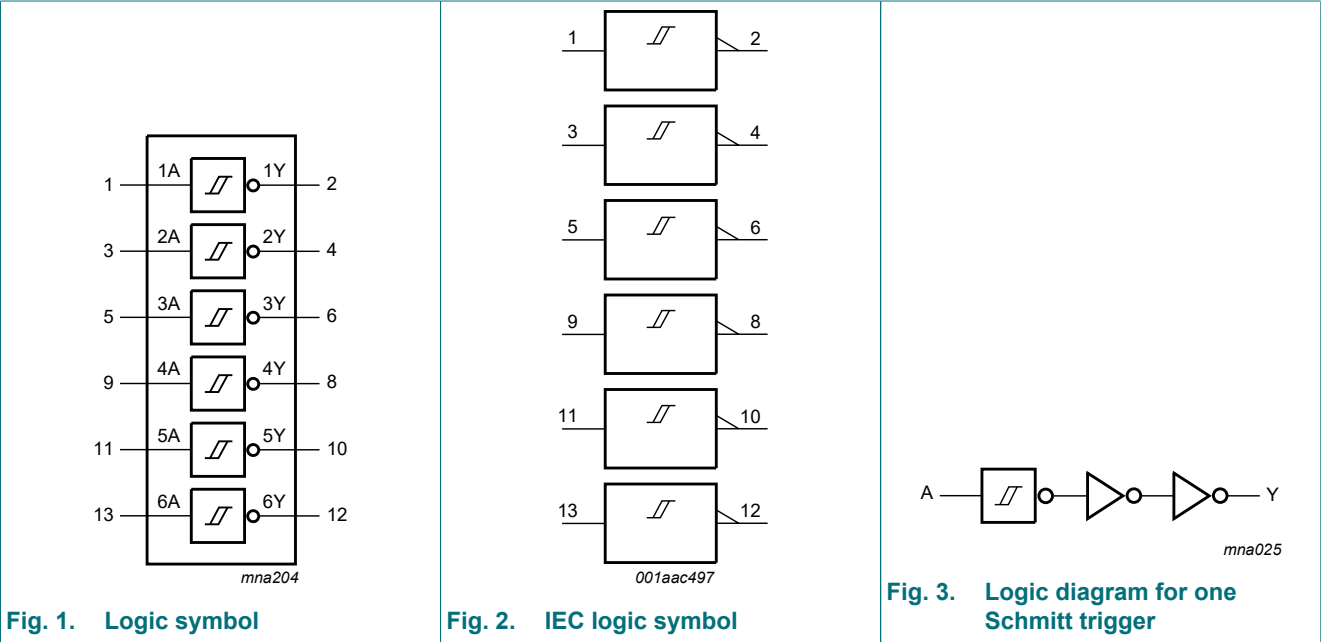
- Wave and pulse shapers for highly noisy environments
- Astable multivibrators
- Monostable multivibrators

4. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LV14D	-40 °C to +125 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1
74LV14PW	-40 °C to +125 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1
74LV14BQ	-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

D package
SOT108-1 (SO14)

aaa-035254

PW package
SOT402-1 (TSSOP14)

aaa-035585

BQ package
SOT762-1 (DHVQFN14)

aaa-037711

Transparent top view

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

6.2. 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

7. Functional description

Table 3. Function table

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

Input nA	Output nY
L	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	+7.0	V
I _{IK}	input clamping current	V _I < -0.5 V or V _I > V _{CC} + 0.5 V [1]	-	±20	mA
I _{OK}	output clamping current	V _O < -0.5 V or V _O > V _{CC} + 0.5 V [1]	-	±50	mA
I _O	output current	V _O = -0.5 V to (V _{CC} + 0.5 V)	-	±25	mA
I _{CC}	supply current		-	50	mA
I _{GND}	ground current		-50	-	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.

9. 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	[1]	1.0	3.3	5.5	V
V _I	input voltage		0	-	V _{CC}	V
V _O	output voltage		0	-	V _{CC}	V
T _{amb}	ambient temperature		-40	+25	+125	°C

- [1] The static characteristics are guaranteed from V_{CC} = 1.2 V to V_{CC} = 5.5 V, but LV devices are guaranteed to function down to V_{CC} = 1.0 V (with input levels GND or V_{CC}).

10. Static characteristics

Table 6. Static characteristics

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 _{T+} or V _{T-}						
		I _O = -100 µA; V _{CC} = 1.2 V	-	1.2	-	-	-	V
		I _O = -100 µA; V _{CC} = 2.0 V	1.8	2.0	-	1.8	-	V
		I _O = -100 µA; V _{CC} = 2.7 V	2.5	2.7	-	2.5	-	V
		I _O = -100 µA; V _{CC} = 3.0 V	2.8	3.0	-	2.8	-	V
		I _O = -100 µA; V _{CC} = 4.5 V	4.3	4.5	-	4.3	-	V
		I _O = -6 mA; V _{CC} = 3.0 V	2.4	2.82	-	2.2	-	V
		I _O = -12 mA; V _{CC} = 4.5 V	3.6	4.2	-	3.5	-	V
V _{OL}	LOW-level output voltage	V _I = V _{T+} or V _{T-}						
		I _O = 100 µA; V _{CC} = 1.2 V	-	0	-	-	-	V
		I _O = 100 µA; V _{CC} = 2.0 V	-	0	0.2	-	0.2	V
		I _O = 100 µA; V _{CC} = 2.7 V	-	0	0.2	-	0.2	V
		I _O = 100 µA; V _{CC} = 3.0 V	-	0	0.2	-	0.2	V
		I _O = 100 µA; V _{CC} = 4.5 V	-	0	0.2	-	0.2	V
		I _O = 6 mA; V _{CC} = 3.0 V	-	0.25	0.40	-	0.50	V
		I _O = 12 mA; V _{CC} = 4.5 V	-	0.35	0.55	-	0.65	V
I _I	input leakage current	V _I = V _{CC} or GND; V _{CC} = 5.5 V	-	-	1.0	-	1.0	µA
I _{CC}	supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V	-	-	20.0	-	40	µA
ΔI _{CC}	additional supply current	per input; V _I = V _{CC} - 0.6 V; V _{CC} = 2.7 V to 3.6 V	-	-	500	-	850	µA
C _I	input capacitance		-	3.5	-	-	-	pF

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

11. Dynamic characteristics

Table 7. Dynamic characteristics

GND = 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} = 1.2 V	-	80	-	-	-	ns
		V _{CC} = 2.0 V	-	27	37	-	48	ns
		V _{CC} = 2.7 V	-	20	28	-	35	ns
		V _{CC} = 3.0 V to 3.6 V; C _L = 15 pF [3]	-	13	-	-	-	ns
		V _{CC} = 3.0 V to 3.6 V [3]	-	15	22	-	28	ns
		V _{CC} = 4.5 V to 5.5 V	-	-	18	-	23	ns
C _{PD}	power dissipation capacitance	C _L = 50 pF; f _i = 1 MHz; V _I = GND to V _{CC} [4]	-	15	-	-	-	pF

- [1] All typical values are measured at T_{amb} = 25 °C.
- [2] t_{pd} is the same as t_{PLH} and t_{PHL}.
- [3] Typical values are measured at nominal supply voltage (V_{CC} = 3.3 V).
- [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
- 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.

11.1. Waveforms and test circuit

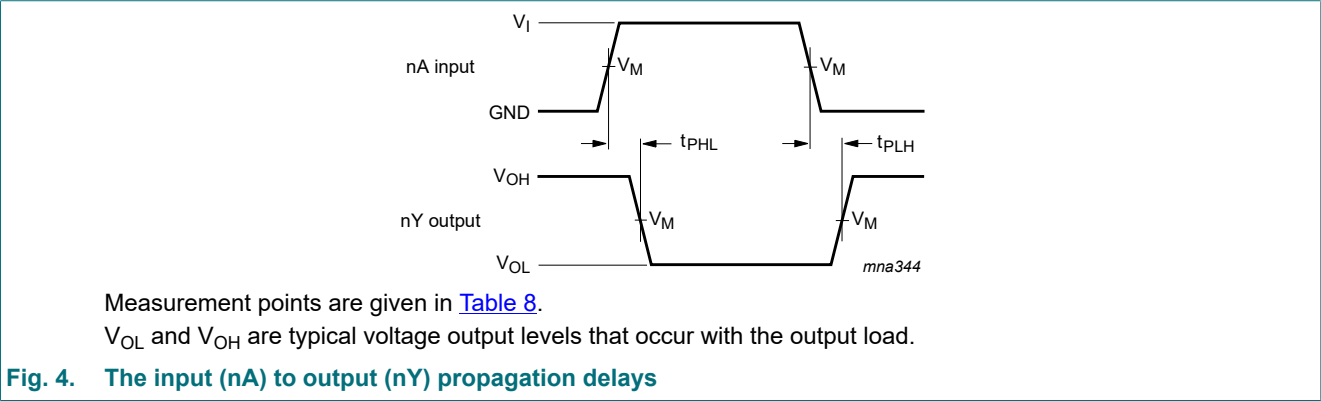
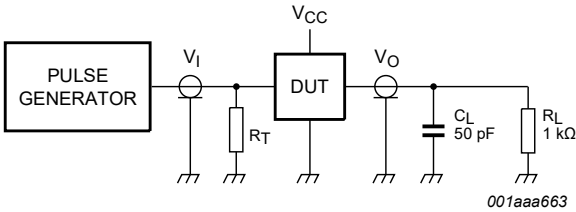


Table 8. Measurement points

Supply voltage	Input	Output
V _{CC}	V _M	V _M
< 2.7 V	0.5V _{CC}	0.5V _{CC}
2.7 V to 3.6 V	1.5 V	1.5 V
≥ 4.5 V	0.5V _{CC}	0.5V _{CC}



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;
 R_L = Load resistance;
 C_L = Load capacitance including jig and probe capacitance.

Fig. 5. Test circuit for measuring switching times

Table 9. Test data

Supply voltage	Input	
V_{CC}	V_I	t_r, t_f
< 2.7 V	V_{CC}	≤ 2.5 ns
2.7 V to 3.6 V	2.7 V	≤ 2.5 ns
≥ 4.5 V	V_{CC}	≤ 2.5 ns

12. Transfer characteristics

Table 10. Transfer characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); see [Fig. 6](#) and [Fig. 7](#).

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	$V_{CC} = 1.2$ V	-	0.70	-	-	-	V
		$V_{CC} = 2.0$ V	0.8	1.10	1.4	0.8	1.4	V
		$V_{CC} = 2.7$ V	1.0	1.45	2.0	1.0	2.0	V
		$V_{CC} = 3.0$ V	1.2	1.60	2.2	1.2	2.2	V
		$V_{CC} = 3.6$ V	1.5	1.95	2.4	1.5	2.4	V
		$V_{CC} = 4.5$ V	1.7	2.50	3.15	1.7	3.15	V
		$V_{CC} = 5.5$ V	2.1	3.00	3.85	2.1	3.85	V
V_{T-}	negative-going threshold voltage	$V_{CC} = 1.2$ V	-	0.34	-	-	-	V
		$V_{CC} = 2.0$ V	0.3	0.65	0.9	0.3	0.9	V
		$V_{CC} = 2.7$ V	0.4	0.90	1.4	0.4	1.4	V
		$V_{CC} = 3.0$ V	0.6	1.05	1.5	0.6	1.5	V
		$V_{CC} = 3.6$ V	0.8	1.30	1.8	0.8	1.8	V
		$V_{CC} = 4.5$ V	0.9	1.60	2.0	0.9	2.0	V
		$V_{CC} = 5.5$ V	1.1	2.00	2.6	1.1	2.6	V

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
V _H	hysteresis voltage	V _{CC} = 1.2 V	-	0.3	-	-	-	V
		V _{CC} = 2.0 V	0.2	0.55	0.8	0.2	0.8	V
		V _{CC} = 2.7 V	0.3	0.60	1.1	0.3	1.1	V
		V _{CC} = 3.0 V	0.4	0.65	1.2	0.4	1.2	V
		V _{CC} = 3.6 V	0.4	0.70	1.2	0.4	1.2	V
		V _{CC} = 4.5 V	0.4	0.80	1.4	0.4	1.4	V
		V _{CC} = 5.5 V	0.6	1.00	1.5	0.6	1.5	V

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

12.1. Waveforms transfer characteristics

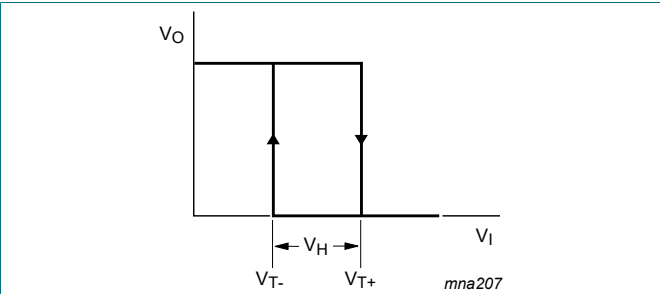


Fig. 6. Transfer characteristic

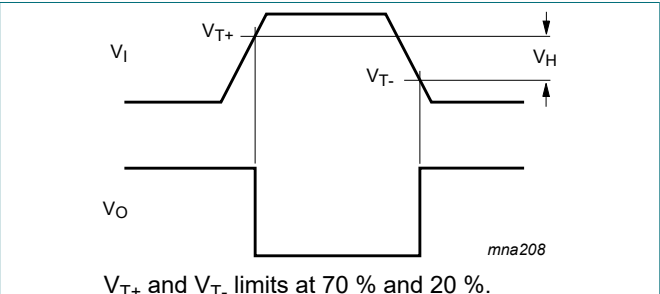


Fig. 7. Definition of V_{T+}, V_{T-} and V_H

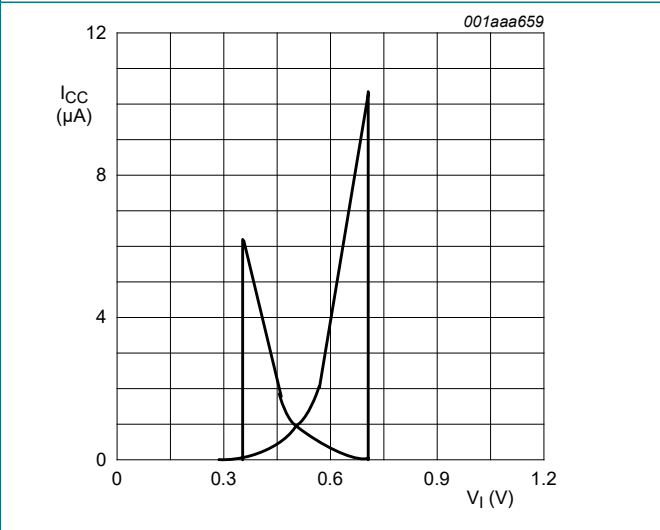


Fig. 8. Typical 74LV14 transfer characteristics

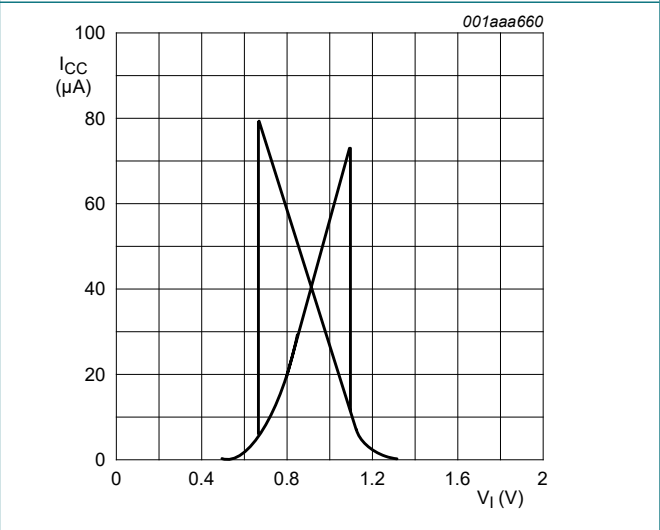


Fig. 9. Typical 74LV14 transfer characteristics

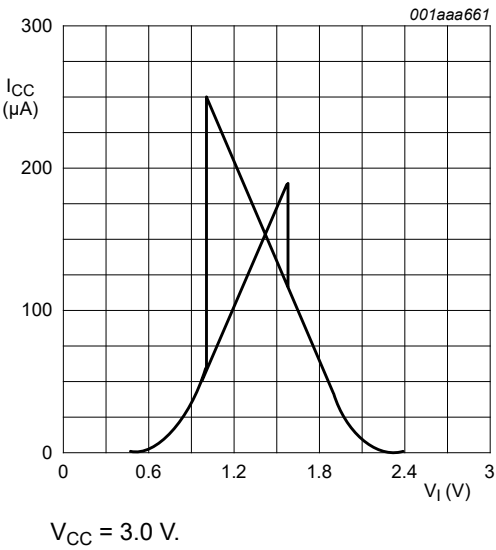


Fig. 10. Typical 74LV14 transfer characteristics

13. Application information

The slow input rise and fall times cause additional power dissipation, this can be calculated using the following formula:

$P_{add} = f_i \times (t_r \times \Delta I_{CC(AV)} + t_f \times \Delta I_{CC(AV)}) \times V_{CC}$ where:

P_{add} = additional power dissipation (μW);

f_i = input frequency (MHz);

t_r = rise time (ns); 10 % to 90 %;

t_f = fall time (ns); 90 % to 10 %;

$\Delta I_{CC(AV)}$ = average additional supply current (μA).

Average $\Delta I_{CC(AV)}$ differs with positive or negative input transitions, as shown in Fig. 11.

An example of a relaxation circuit using the 74LV14 is shown in Fig. 12.

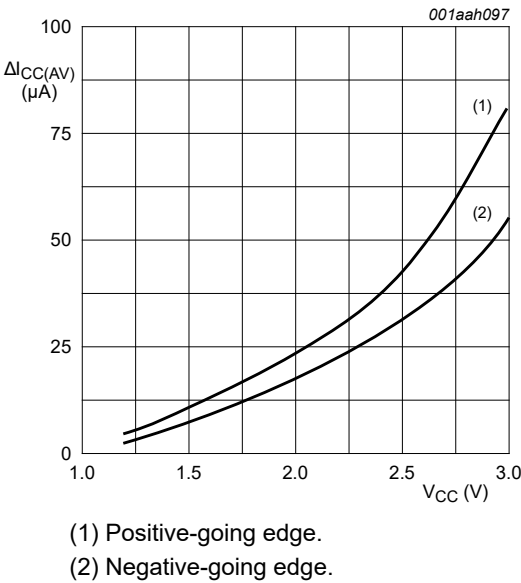
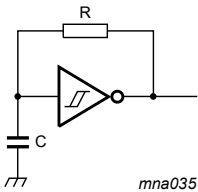


Fig. 11. Average additional supply current as a function of V_{CC}



$$f = \frac{1}{T} \approx \frac{1}{0.8 \times RC}$$

Fig. 12. Relaxation oscillator

14. Package outline

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

SOT108-1

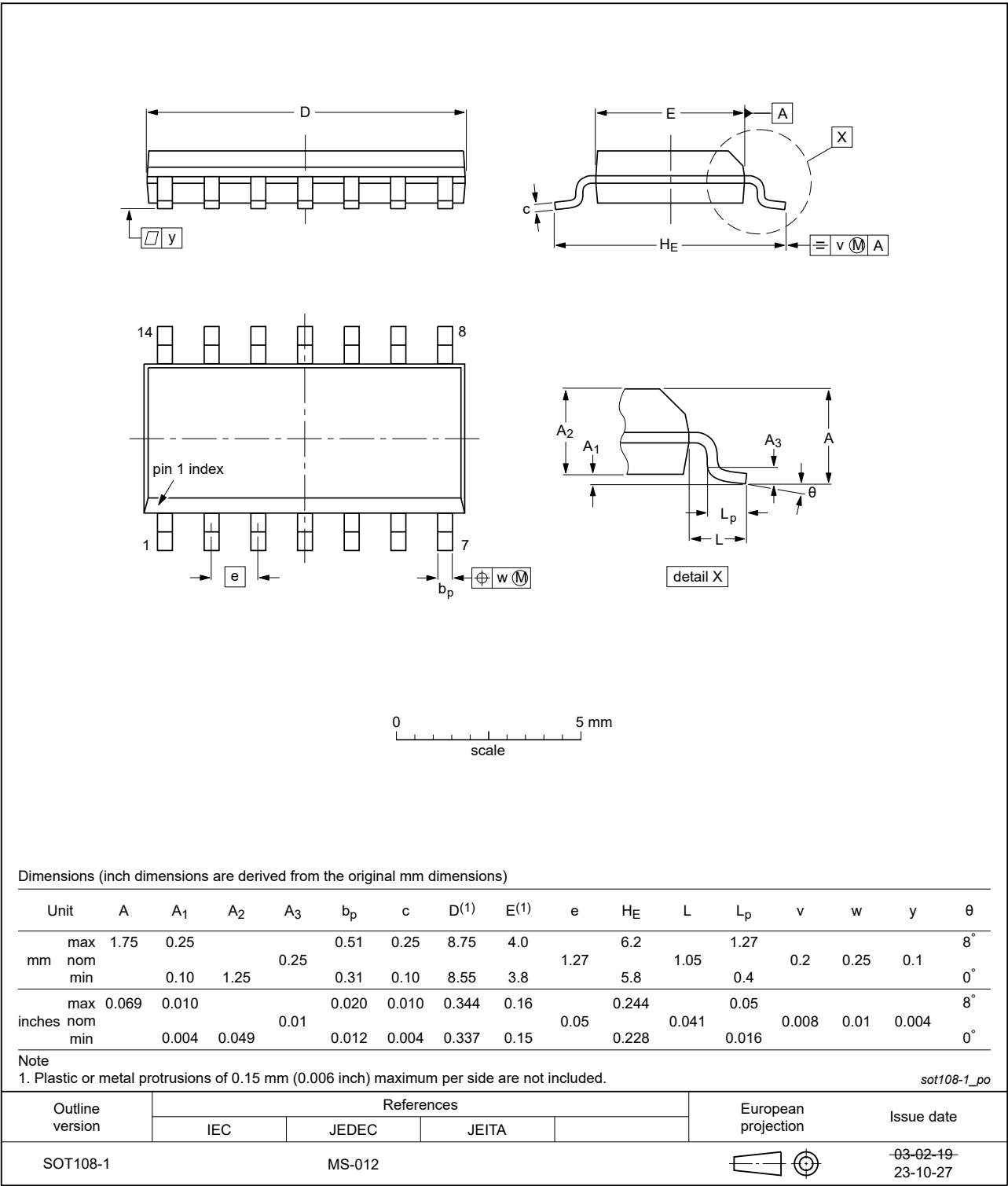


Fig. 13. Package outline SOT108-1 (SO14)

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

SOT402-1

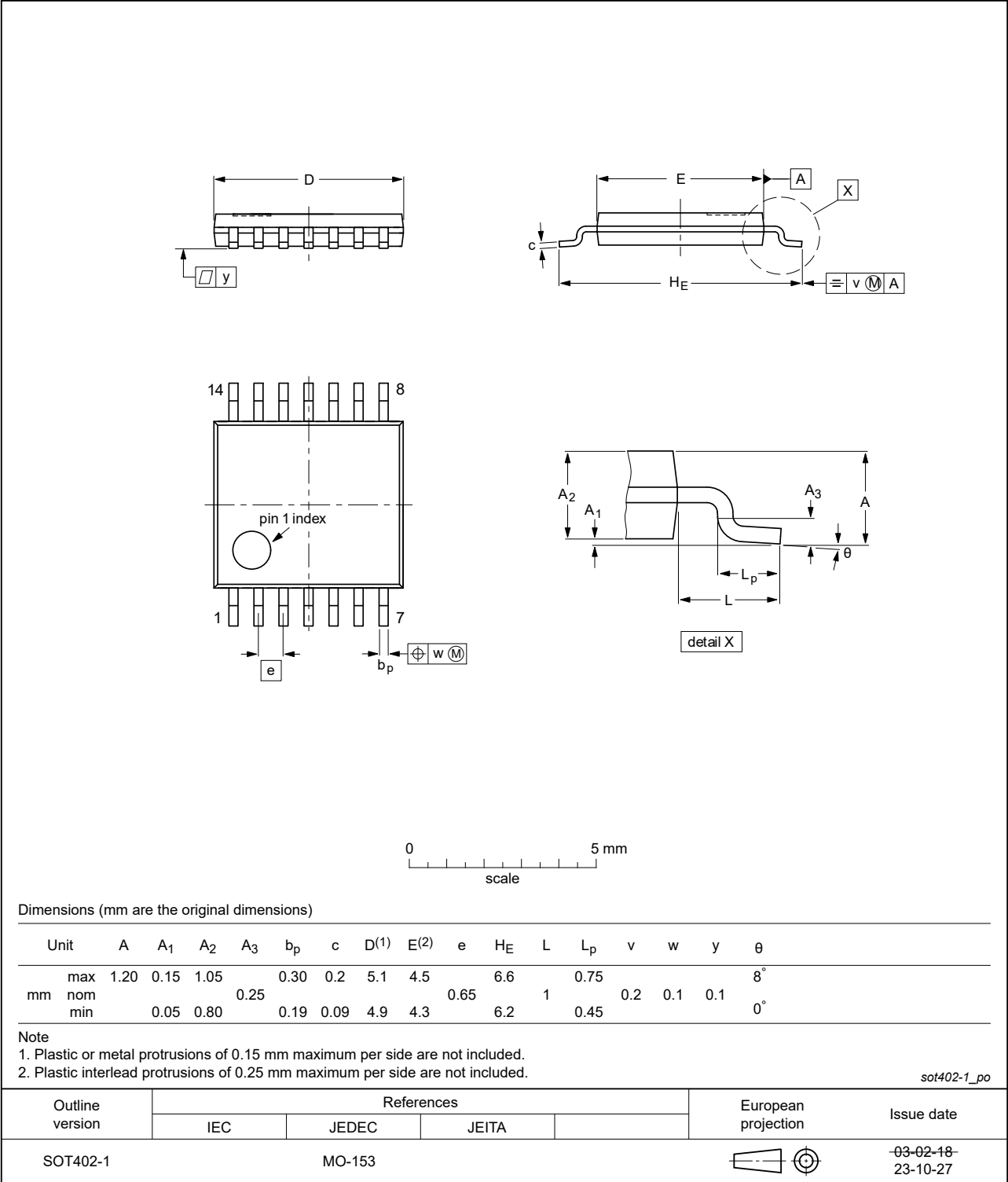


Fig. 14. Package outline SOT402-1 (TSSOP14)

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

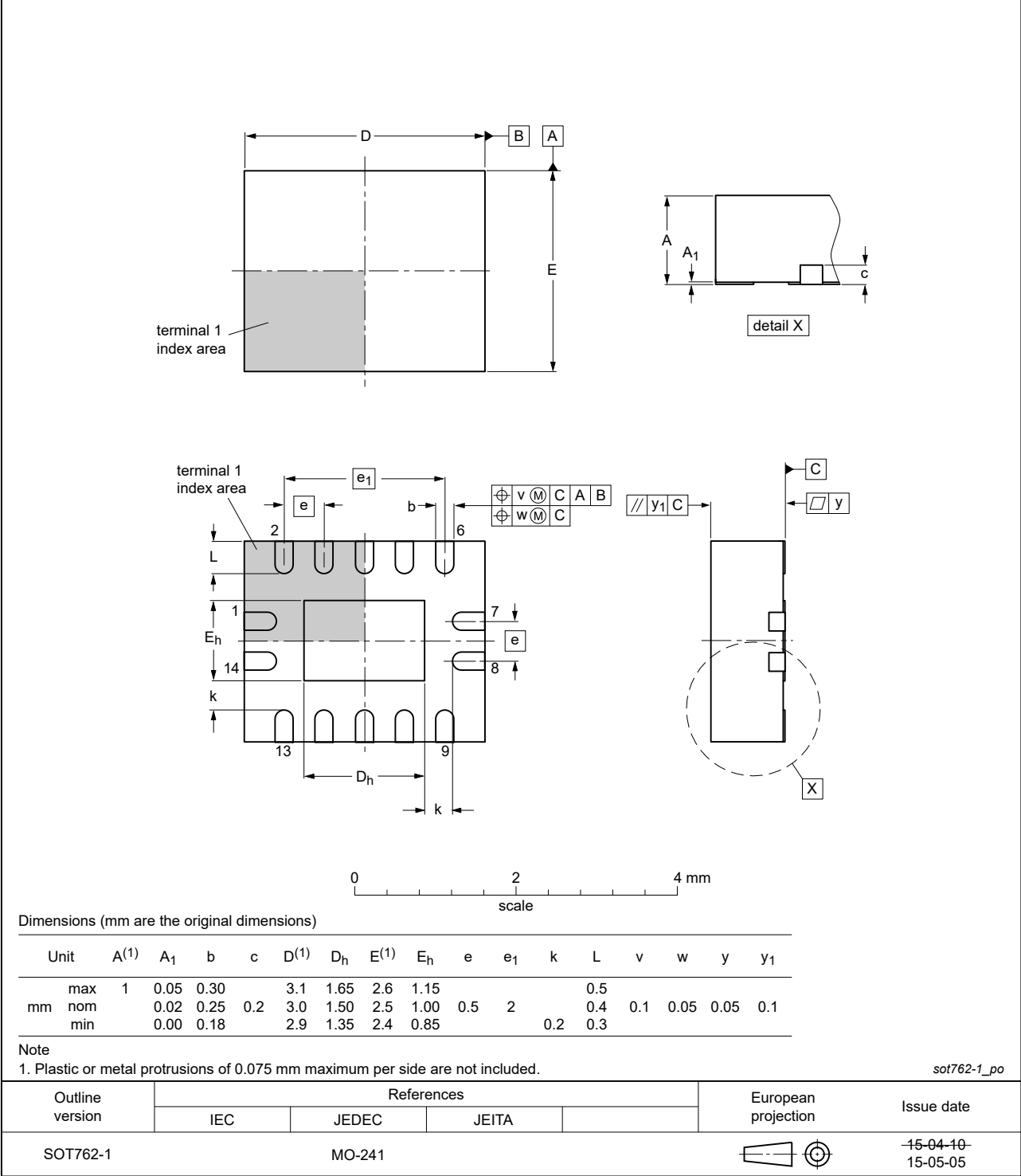


Fig. 15. Package outline SOT762-1 (DHVQFN14)

15. 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

16. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LV14 v.10	20240123	Product data sheet	-	74LV14 v.9
Modifications:	- Section 2: ESD specification updated according to the latest JEDEC standard. - Fig. 13, Fig. 14: Aligned SO and TSSOP package outline drawings to JEDEC MS-012 and MO-153			
74LV14 v.9	20210914	Product data sheet	-	74LV14 v.8
Modifications:	- Type number 74LV14DB (SOT337-1/SSOP14) removed. - Section 2 updated.			
74LV14 v.8	20210304	Product data sheet	-	74LV14 v.7
Modifications:	- 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. - Section 8: Derating values for P_{tot} total power dissipation updated.			
74LV14 v.7	20151209	Product data sheet	-	74LV14 v.6
Modifications:	Type number 74LV14N (SOT27-1) removed.			
74LV14 v.6	20111212	Product data sheet	-	74LV14 v.5
Modifications:	Legal pages updated.			
74LV14 v.5	20110105	Product data sheet	-	74LV14 v.4
74LV14 v.4	20090702	Product data sheet	-	74LV14 v.3
74LV14 v.3	20071220	Product data sheet	-	74LV14 v.2
74LV14 v.2	19980420	Product specification	-	74LV14 v.1
74LV14 v.1	19970203	Product specification	-	-

17. 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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Contents

1. General description..... 1

2. Features and benefits..... 1

3. Applications..... 1

4. Ordering information.....2

5. Functional diagram.....2

6. Pinning information.....3

6.1. Pinning.....3

6.2. Pin description..... 3

7. Functional description..... 3

8. Limiting values..... 4

9. Recommended operating conditions.....4

10. Static characteristics.....5

11. Dynamic characteristics.....6

11.1. Waveforms and test circuit..... 6

12. Transfer characteristics..... 7

12.1. Waveforms transfer characteristics.....8

13. Application information..... 9

14. Package outline..... 10

15. Abbreviations..... 13

16. Revision history.....13

17. Legal information.....14

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