

74LVT04

3.3 V Hex inverter

Rev. 3 — 1 April 2021

Product data sheet

1. General description

The 74LVT04 is a hex inverter. 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

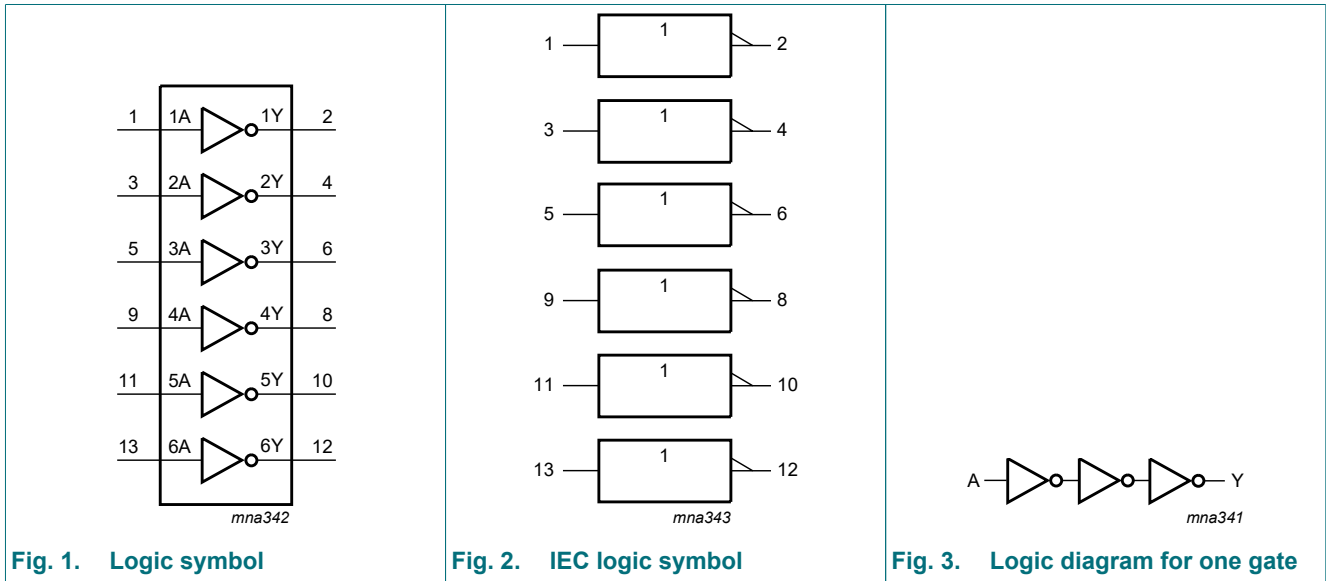
- Wide supply voltage range from 2.7 to 3.6 V
- Overvoltage tolerant inputs to 5.5 V
- BiCMOS high speed and output drive
- Direct interface with TTL levels
- No bus current loading when output is tied to 5 V bus
- Power-up 3-state
- I_{OFF} circuitry provides partial Power-down mode operation
- Latch-up performance exceeds 500 mA per JESD 78 Class II Level B
- Complies with JEDEC standards:
 - JESD8C (2.7 V to 3.6 V)
- ESD protection:
 - HBM JESD22-A114E exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V
- Specified from -40 °C to +85 °C

3. Ordering information

Table 1. Ordering information

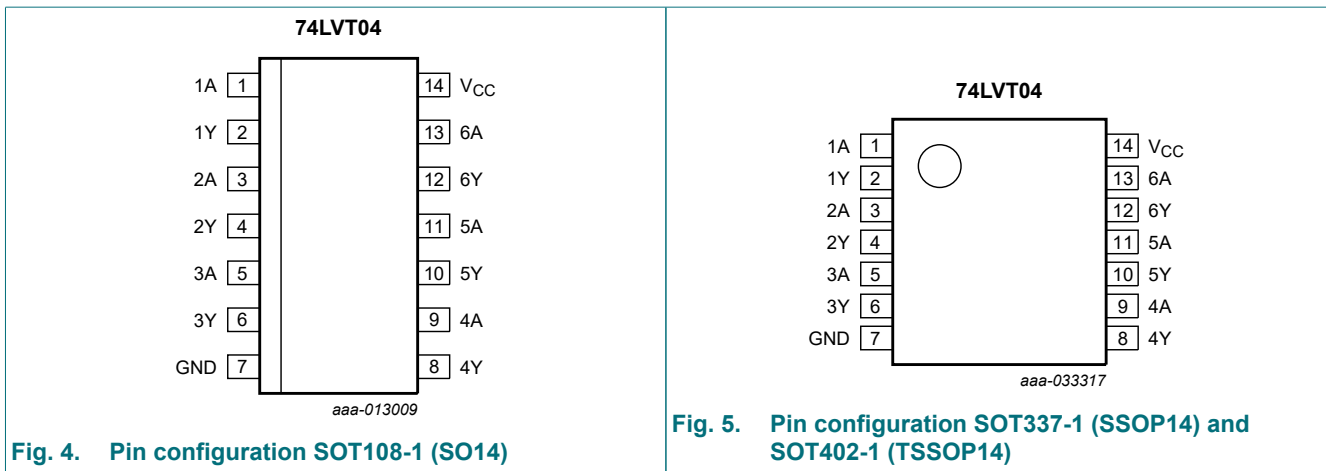
Type number	Package			
	Temperature range	Name	Description	Version
74LVT04D	-40 °C to +85 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1
74LVT04DB	-40 °C to +85 °C	SSOP14	plastic shrink small outline package; 14 leads; body width 5.3 mm	SOT337-1
74LVT04PW	-40 °C to +85 °C	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



5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
nA	1, 3, 5, 9, 11, 13	data input
nY	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; Z = high-impedance OFF-state.

Input	Output
nA	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	+7.0	V
V_O	output voltage	output in OFF-state or HIGH-state [1]	-0.5	+7.0	V
I_{IK}	input clamping current	$V_I < 0$ V	-50	-	mA
I_{OK}	output clamping current	$V_O < 0$ V	-50	-	mA
I_O	output current	output in LOW-state	-	64	mA
		output in HIGH-state	-	-32	mA
T_{stg}	storage temperature		-65	+150	°C
T_j	junction temperature	[2]	-	150	°C
P_{tot}	total power dissipation	$T_{amb} = -40$ °C to +85 °C [3]	-	500	mW

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

[2] The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability.

[3] For SOT337-1 (SSOP14) package: P_{tot} derates linearly with 7.3 mW/K above 81 °C.
For SOT402-1 (TSSOP14) package: P_{tot} derates linearly with 7.3 mW/K above 81 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage		2.7	3.6	V
V_I	input voltage		0	5.5	V
V_{IH}	HIGH-level input voltage		2.0	-	V
V_{IL}	LOW-level input voltage		-	0.8	V
I_{OH}	HIGH-level output current		-	-20	mA
I_{OL}	LOW-level output current		-	32	mA
T_{amb}	ambient temperature	in free air	-40	+85	°C
$\Delta t/\Delta V$	input transition rise and fall rate	outputs enabled	-	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			Unit
			Min	Typ [1]	Max	
V_{IK}	input clamp voltage	$V_{CC} = 2.7 \text{ V}$; $I_{IK} = -18 \text{ mA}$	-	-	-1.2	V
V_{OH}	LOW-level input voltage	$V_{CC} = 2.7 \text{ V}$ to 3.6 V ; $I_{OH} = -100 \mu\text{A}$	$V_{CC} - 0.2$	-	-	V
		$V_{CC} = 2.7 \text{ V}$; $I_{OH} = -6 \text{ mA}$	2.4	-	-	V
		$V_{CC} = 3.0 \text{ V}$; $I_{OH} = -20 \text{ mA}$	2.0	-	-	V
V_{OL}	LOW-level output voltage	$V_{CC} = 2.7 \text{ V}$; $I_{OL} = -100 \mu\text{A}$	-	-	0.2	V
		$V_{CC} = 2.7 \text{ V}$; $I_{OL} = 24 \text{ mA}$	-	-	0.5	V
		$V_{CC} = 3.0 \text{ V}$; $I_{OL} = 32 \text{ mA}$	-	-	0.5	V
I_I	input leakage current	$V_{CC} = 0 \text{ V}$ or 3.6 V ; $V_I = 5.5 \text{ V}$	-	-	10	μA
		$V_{CC} = 3.6 \text{ V}$; $V_I = V_{CC}$ or GND	-	-	± 1	μA
I_{OFF}	output off current	$V_{CC} = 0 \text{ V}$; V_I or $V_O = 0 \text{ V}$ to 4.5 V	-	-	± 100	μA
I_{CCH}	quiescent supply current	$V_{CC} = 3.6 \text{ V}$; outputs HIGH; $V_I = \text{GND}$ or V_{CC} ; $I_O = 0 \text{ V}$	-	-	0.02	mA
I_{CCL}	quiescent supply current	$V_{CC} = 3.6 \text{ V}$; outputs LOW; $V_I = \text{GND}$ or V_{CC} ; $I_O = 0 \text{ V}$	-	1.5	3	mA
ΔI_{CC}	additional supply current	per input pin; $V_{CC} = 3 \text{ V}$ to 3.6 V ; one input at $V_{CC} - 0.6 \text{ V}$; other inputs at V_{CC} or GND	-	-	0.2	mA
C_I	input capacitance	$V_I = 3 \text{ V}$ or 0 V	-	3	-	pF

[1] All typical values are at $V_{CC} = 3.3 \text{ V}$ and $T_{amb} = 25^\circ\text{C}$.

[2] This is the increase in supply current for each input at the specified voltage level other than V_{CC} or GND.

10. Dynamic characteristics

Table 7. Dynamic characteristics

$GND = 0 \text{ V}$; for test circuit, see Fig. 7.

Symbol	Parameter	Conditions	-40 °C to +85 °C			Unit
			Min	Typ [1]	Max	
t_{PLH}	LOW to OFF-state propagation delay	nA to nY; see Fig. 6				
		$V_{CC} = 2.7 \text{ V}$	-	-	4.7	ns
		$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$	1.0	2.6	3.9	ns
t_{PHL}	OFF-state to LOW propagation delay	nA to nY; see Fig. 6				ns
		$V_{CC} = 2.7 \text{ V}$	-	-	3.2	
		$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$	1.0	2.5	3.5	ns

[1] All typical values are at $V_{CC} = 3.3 \text{ V}$ and $T_{amb} = 25^\circ\text{C}$.

10.1. Waveform and test circuit

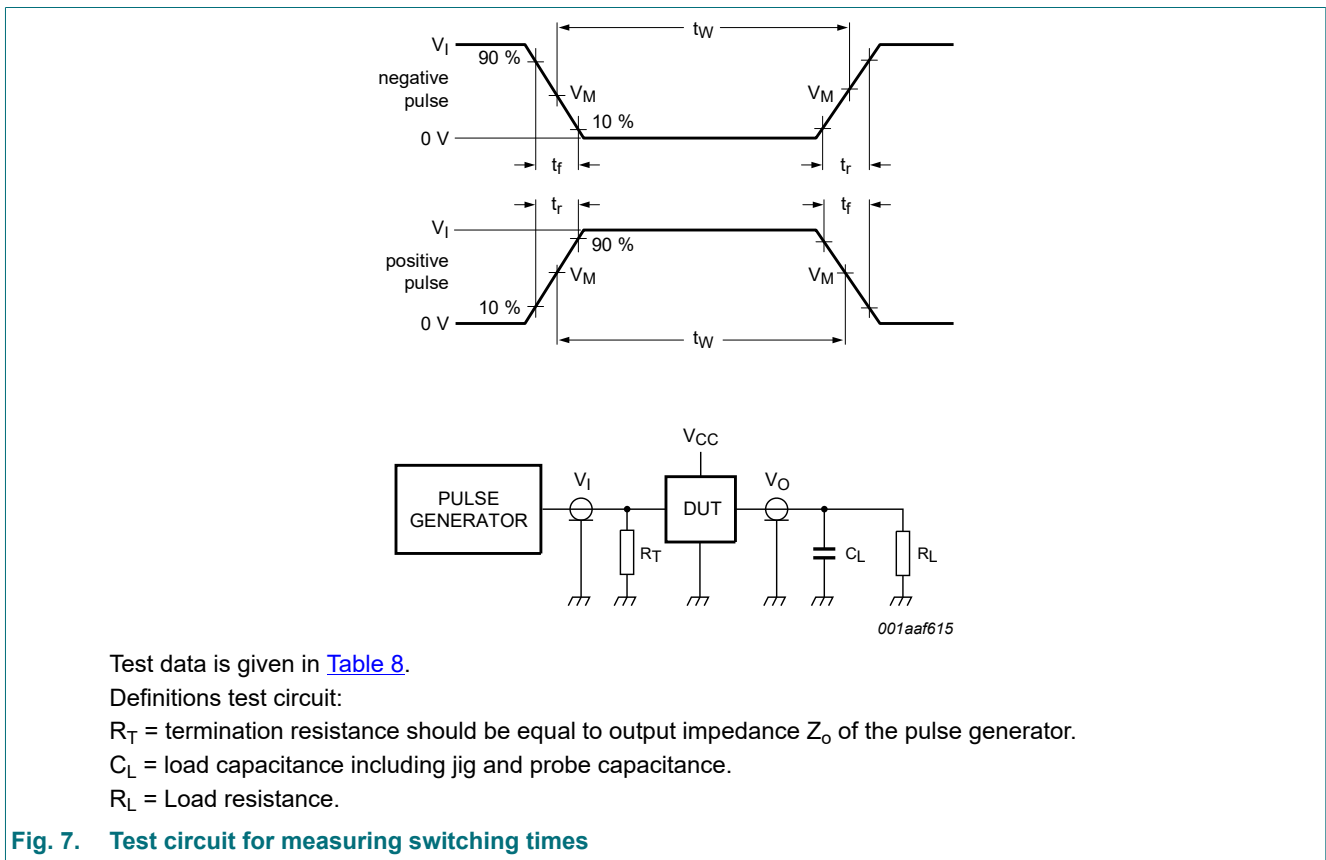
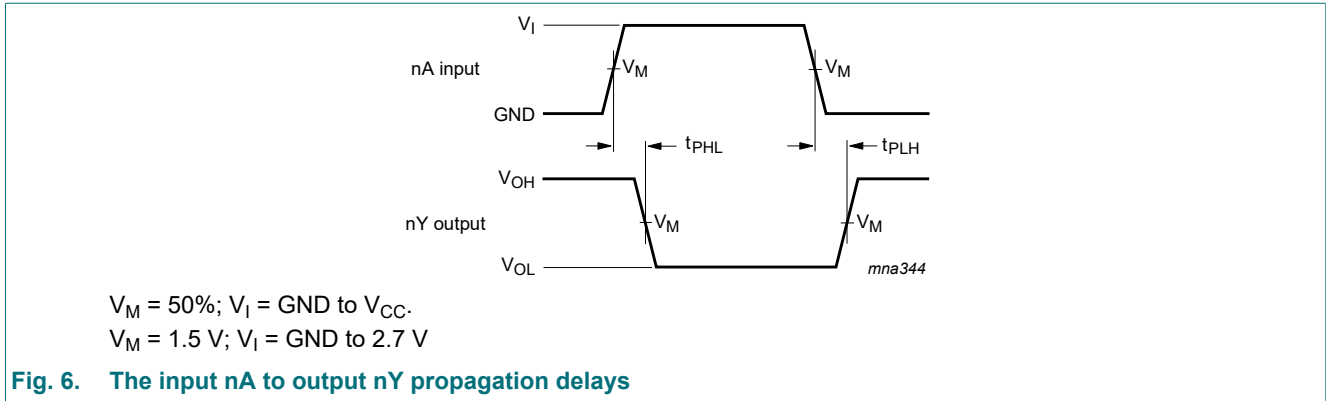


Table 8. Test data

Input				Load	
V_I	f_i	t_W	t_r, t_f	C_L	R_L
2.7 V	$\leq 10 \text{ MHz}$	500 ns	$\leq 2.5 \text{ ns}$	50 pF	500 Ω

11. Package outline

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

SOT108-1

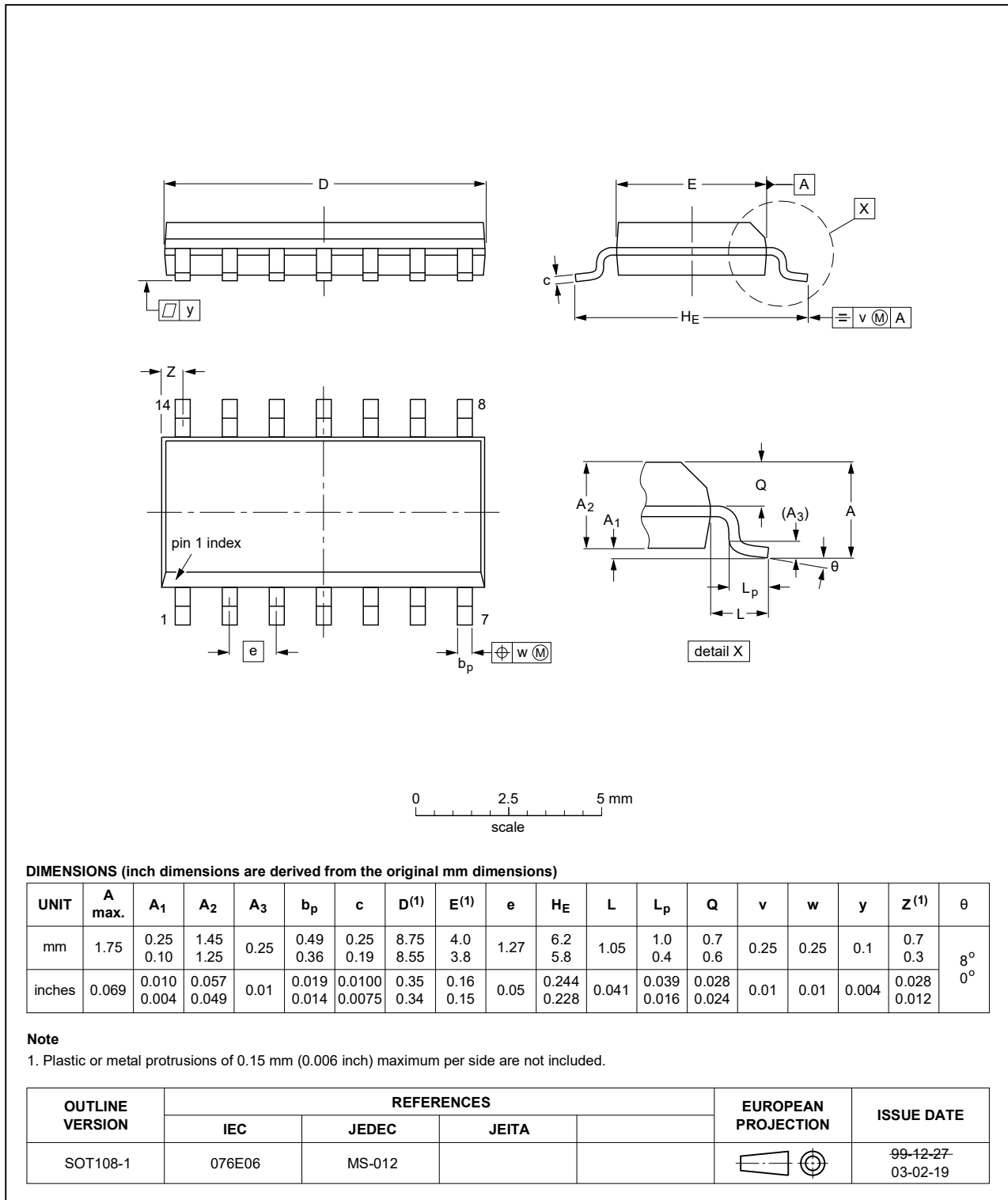


Fig. 8. Package outline SOT108-1 (SO14)

SSOP14: plastic shrink small outline package; 14 leads; body width 5.3 mm

SOT337-1

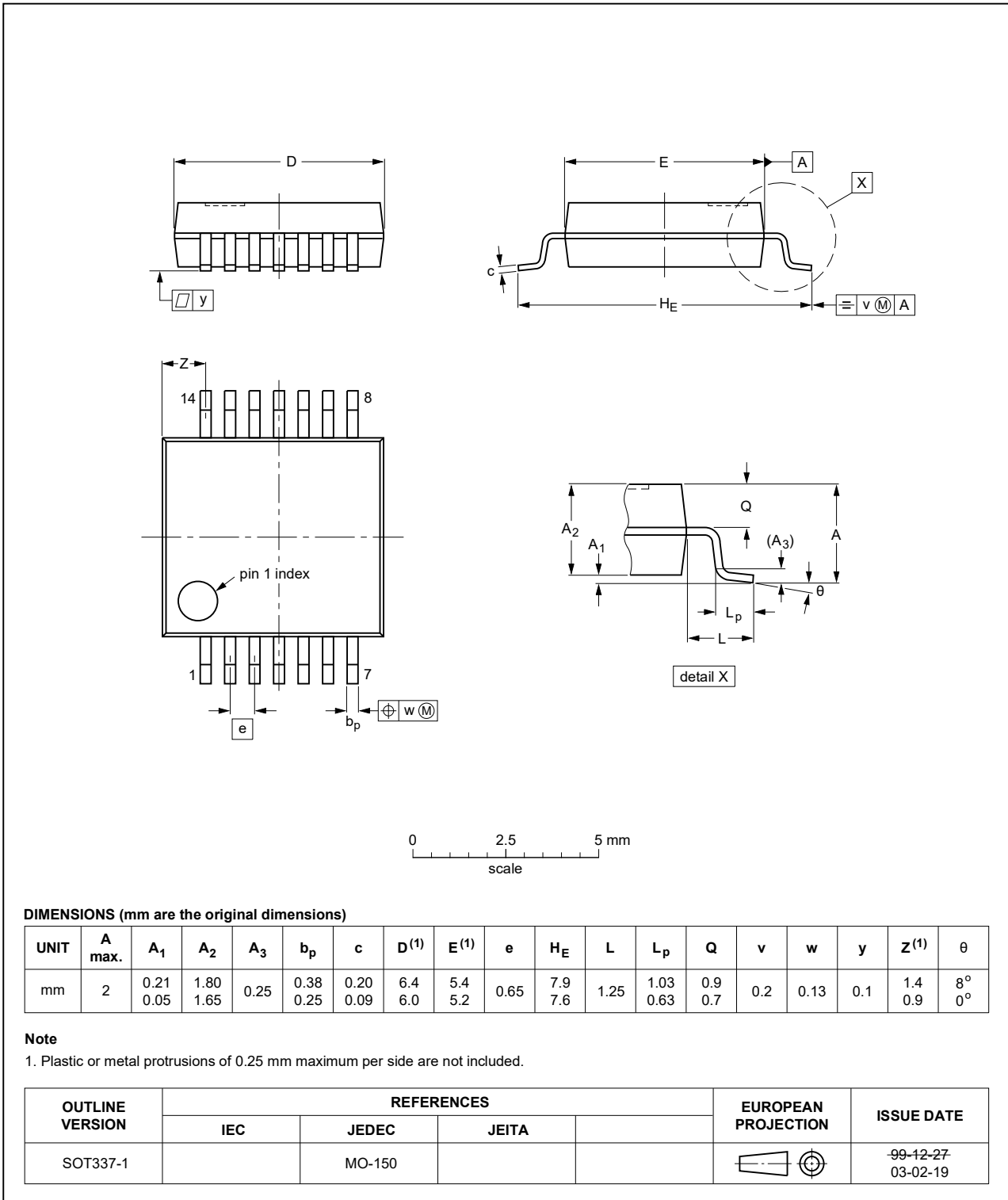


Fig. 9. Package outline SOT337-1 (SSOP14)

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

SOT402-1

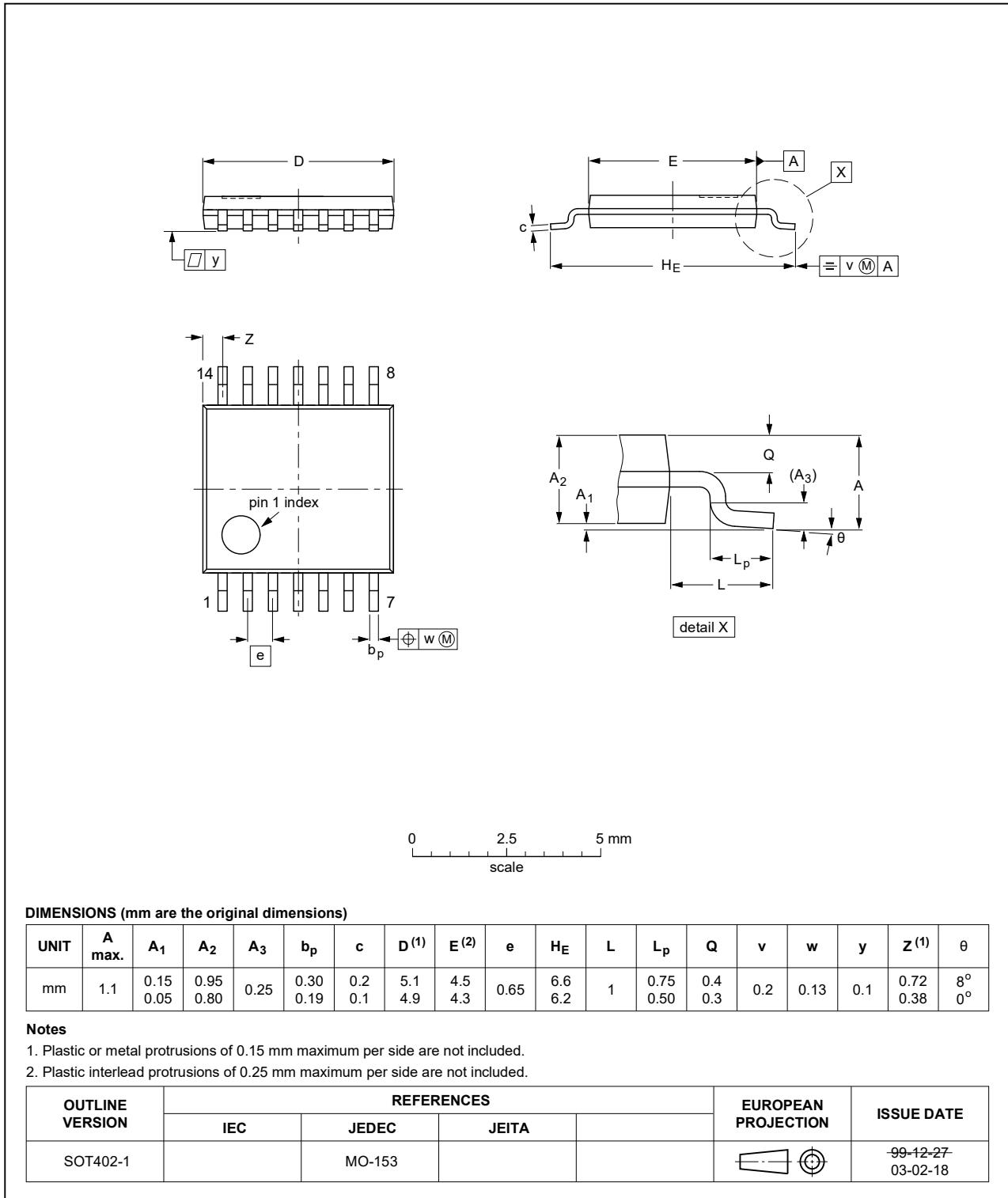


Fig. 10. Package outline SOT402-1 (TSSOP14)

12. Abbreviations

Table 9. Abbreviations

Acronym	Description
BiCMOS	Bipolar Complementary Metal Oxide Semiconductor
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model
TTL	Transistor-Transistor Logic

13. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVT04 v.3	20210401	Product data sheet	-	74LVT04 v.2
Modifications:	<ul style="list-style-type: none"> 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 1 and Section 2 updated. Section 7: Derating values for P_{tot} total power dissipation updated. Section 9: Unit of ΔI_{CC} corrected to mA (Errata). 			
74LVT04 v.2	20140428	Product data sheet	-	74LVT04_1
Modifications:	<ul style="list-style-type: none"> The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. Legal texts have been adapted to the new company name where appropriate. Imported the data sheet into the latest template 			
74LVT04_1	19960828	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.
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