

# 74LVT04

## 3.3 V Hex inverter

Rev. 4 — 12 August 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

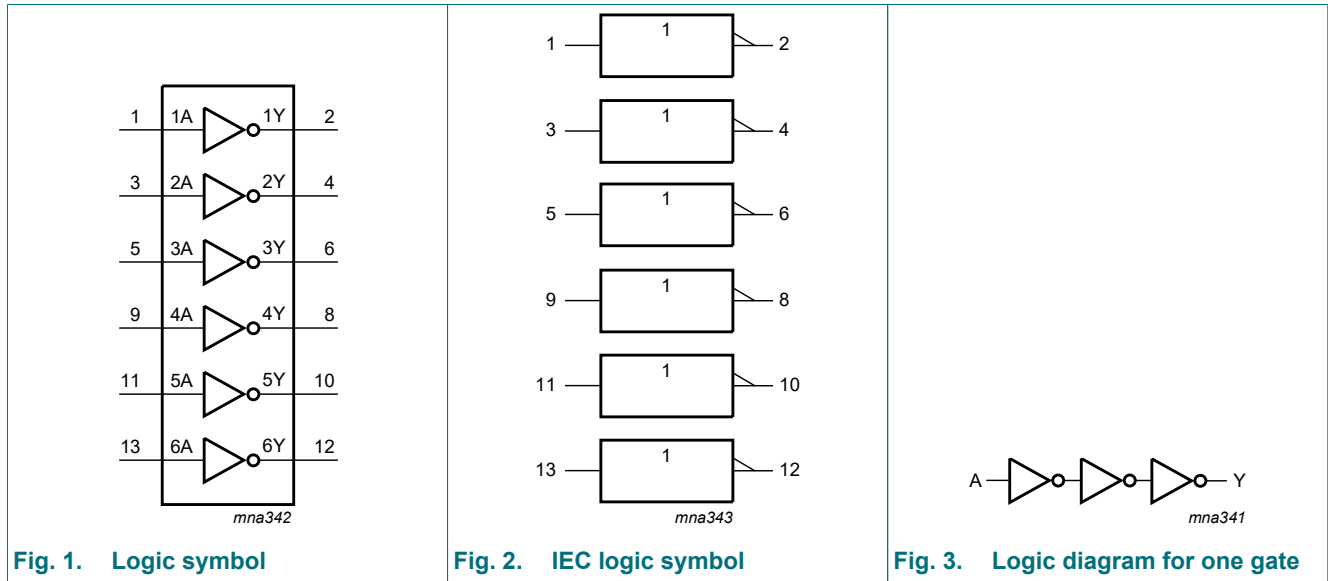
- Wide supply voltage range from 2.7 to 3.6 V
- Overvoltage tolerant inputs to 5.5 V
- BiCMOS high speed and output drive
- Direct interface with TTL levels
- No bus current loading when output is tied to 5 V bus
- Power-up 3-state
- $I_{OFF}$  circuitry provides partial Power-down mode operation
- Latch-up 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

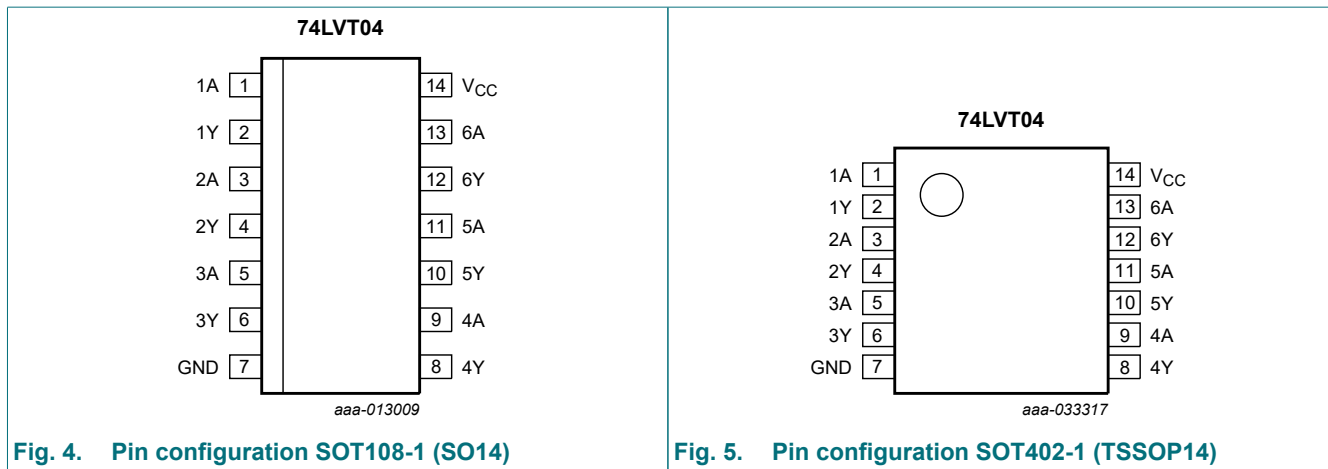
Type number	Package			
	Temperature range	Name	Description	Version
74LVT04D	-40 °C to +85 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1
74LVT04PW	-40 °C to +85 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1

## 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 <sub>CC</sub>	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 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 $3.6 \text{ V}$ ; $I_{OH} = -100 \mu\text{A}$	$V_{CC} - 0.2$	-	-	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 $3.6 \text{ V}$ ; $V_I = 5.5 \text{ V}$	-	-	10	$\mu\text{A}$
		$V_{CC} = 3.6 \text{ V}$ ; $V_I = V_{CC}$ or GND	-	-	$\pm 1$	$\mu\text{A}$
$I_{OFF}$	output off current	$V_{CC} = 0 \text{ V}$ ; $V_I$ or $V_O = 0 \text{ V}$ to $4.5 \text{ V}$	-	-	$\pm 100$	$\mu\text{A}$
$I_{CCH}$	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
$\Delta I_{CC}$	additional supply current	per input pin; $V_{CC} = 3 \text{ V}$ to $3.6 \text{ V}$ ; 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 $0 \text{ V}$	-	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

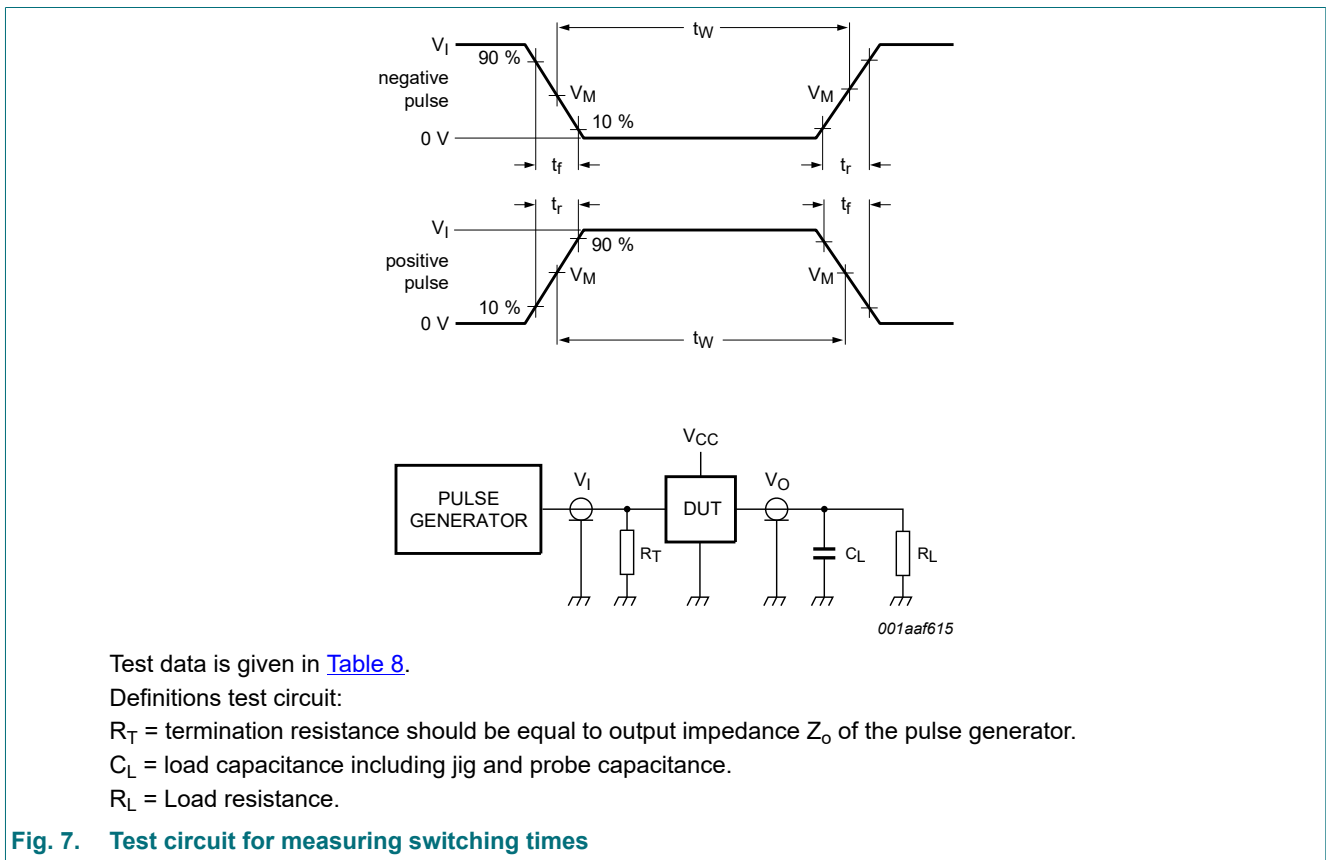
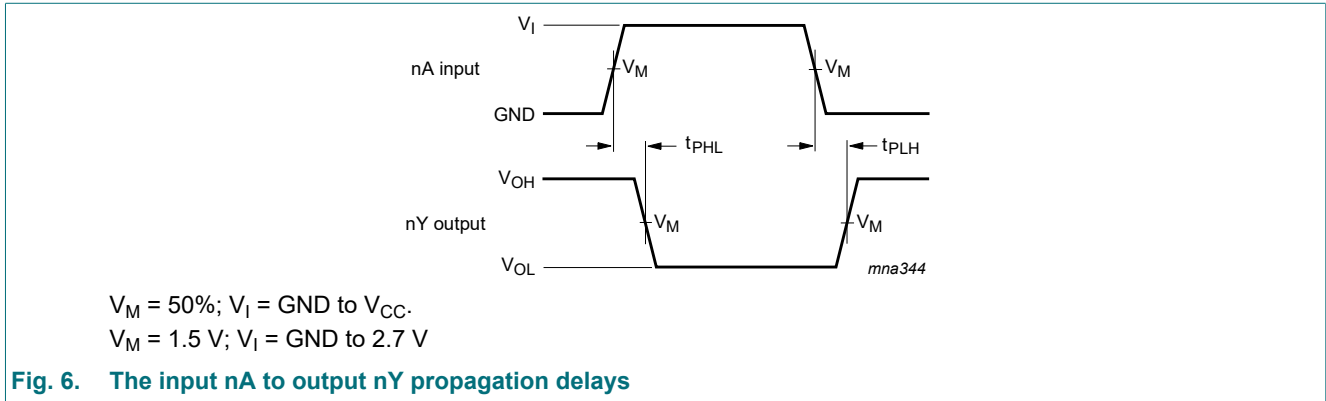


Table 8. Test data

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 $\Omega$

# 11. Package outline

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

SOT108-1

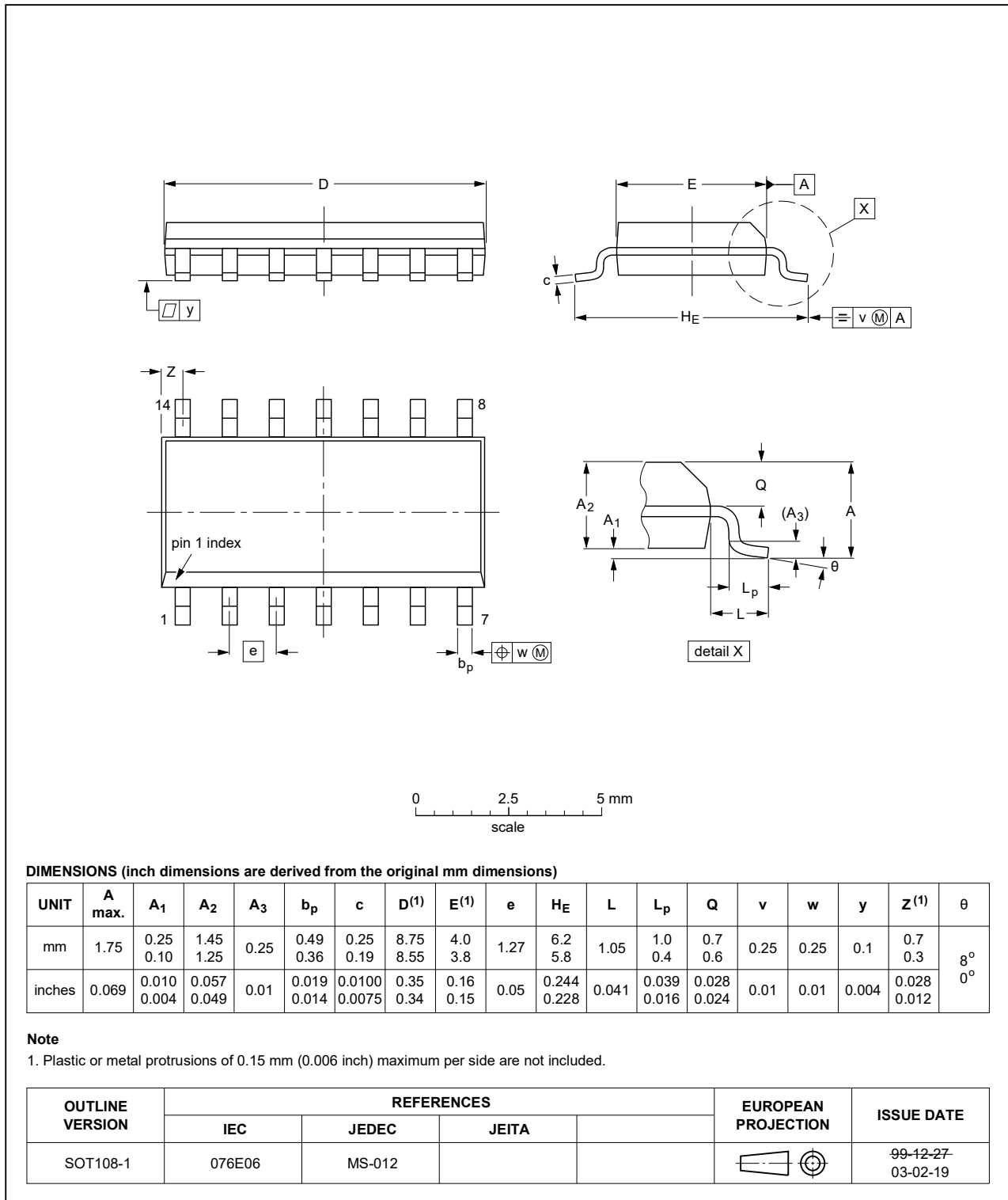


Fig. 8. Package outline SOT108-1 (SO14)

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

SOT402-1

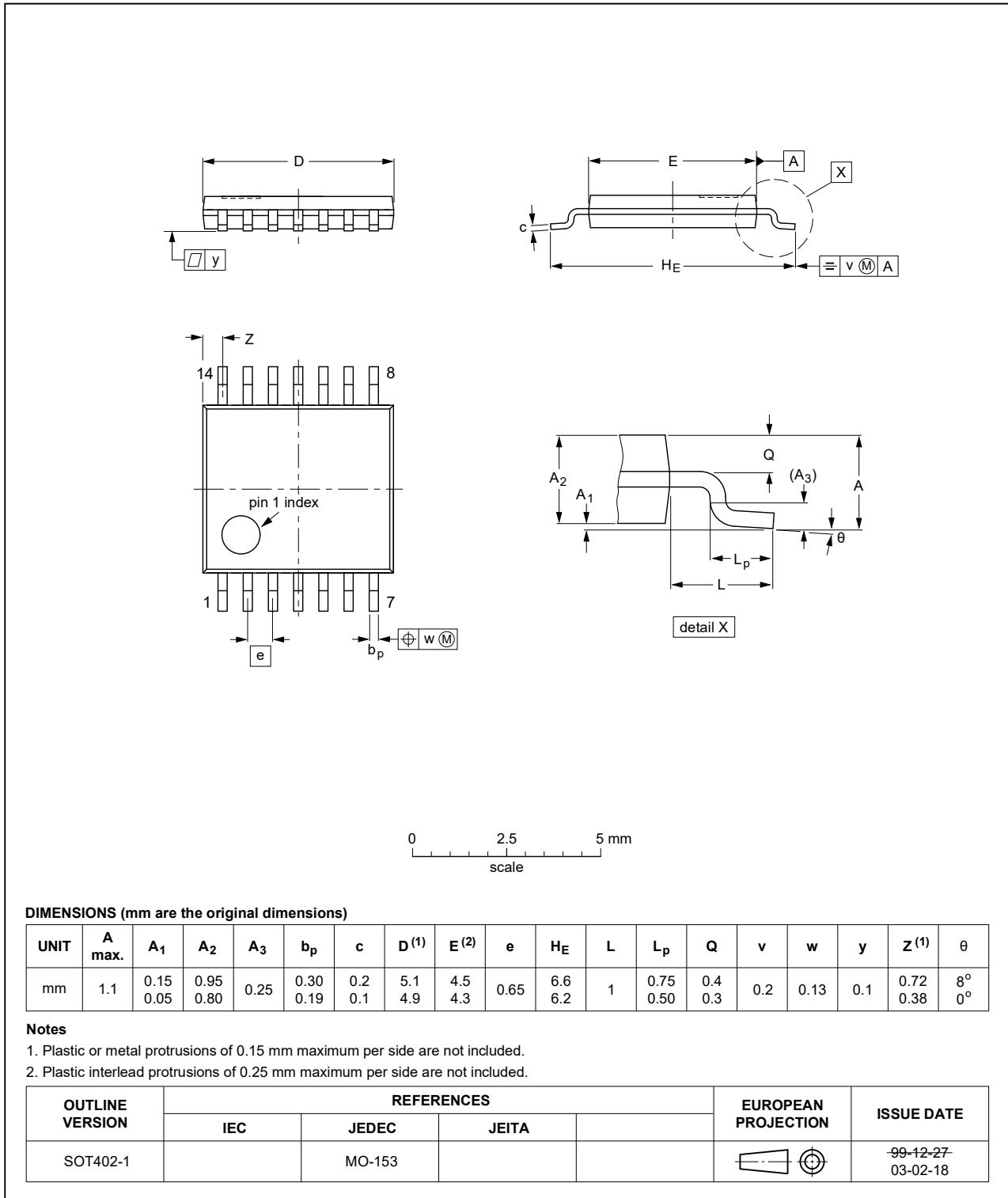


Fig. 9. Package outline SOT402-1 (TSSOP14)

## 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.4	20210812	Product data sheet	-	74LVT04 v.3
Modifications:	<ul style="list-style-type: none"> <li>Type number 74LVT04DB (SOT337-1/SSOP14) removed.</li> </ul>			
74LVT04 v.3	20210401	Product data sheet	-	74LVT04 v.2
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="#">Section 1</a> and <a href="#">Section 2</a> updated.</li> <li><a href="#">Section 7</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li> <li><a href="#">Section 9</a>: Unit of <math>\Delta I_{CC}</math> corrected to mA (Errata).</li> </ul>			
74LVT04 v.2	20140428	Product data sheet	-	74LVT04_1
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li>Imported the data sheet into the latest template</li> </ul>			
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.
- [2] The term 'short data sheet' is explained in section "Definitions".
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