

# 74LVT04-Q100

## 3.3 V Hex inverter

Rev. 2 — 1 April 2021

Product data sheet

## 1. General description

The 74LVT04-Q100 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.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 3) and is suitable for use in automotive applications.

## 2. Features and benefits

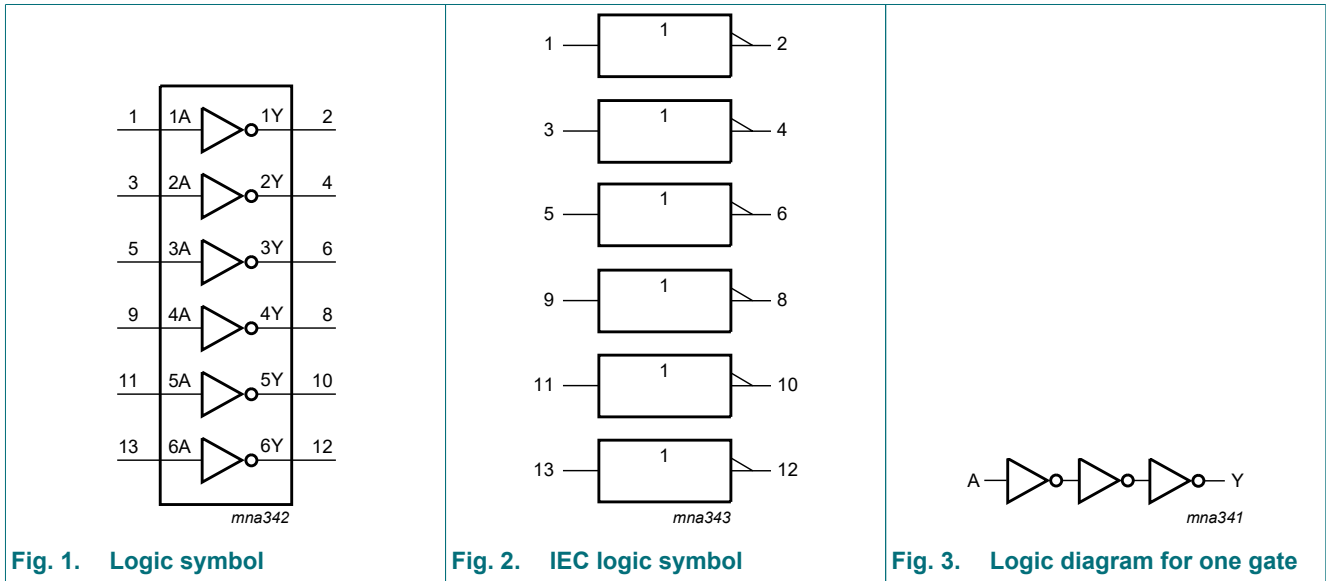
- Automotive product qualification in accordance with AEC-Q100 (Grade 3)
  - Specified from -40 °C to +85 °C
- Wide supply voltage range from 2.7 to 3.6 V
- Overvoltage tolerant inputs to 5.5 V
- BiCMOS high speed and output drive
- Direct interface with TTL levels
- No bus current loading when output 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:
  - 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

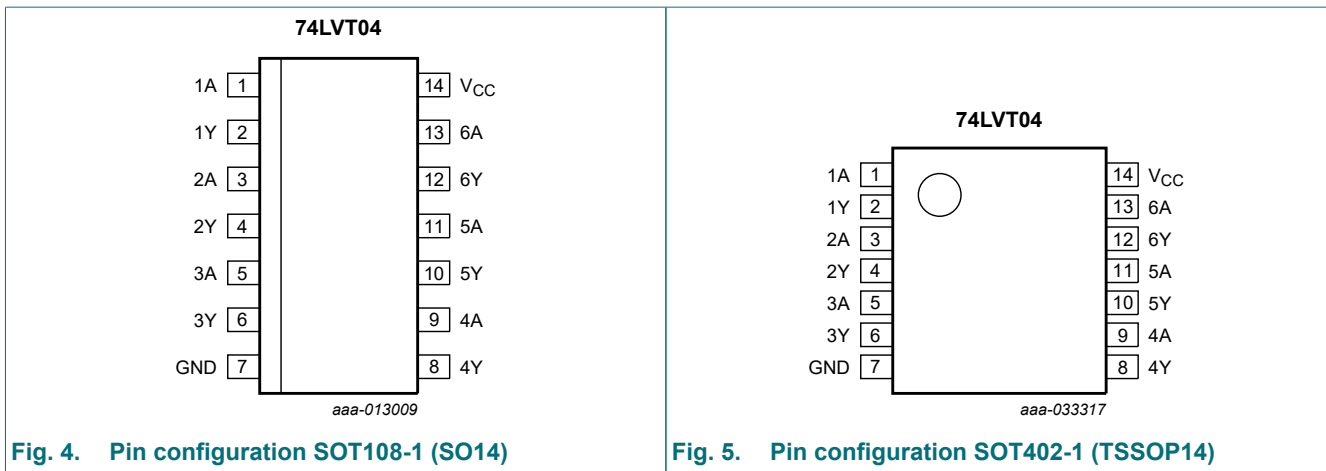
Type number	Package			
	Temperature range	Name	Description	Version
74LVT04D-Q100	-40 °C to +85 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1
74LVT04PW-Q100	-40 °C to +85 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1

### 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 <sub>IK</sub>	input clamp voltage	V <sub>CC</sub> = 2.7 V; I <sub>IK</sub> = -18 mA	-	-	-1.2	V
V <sub>OH</sub>	LOW-level input voltage	V <sub>CC</sub> = 2.7 V to 3.6 V; I <sub>OH</sub> = -100 μA	V <sub>CC</sub> - 0.2	-	-	V
		V <sub>CC</sub> = 2.7 V; I <sub>OH</sub> = -6 mA	2.4	-	-	V
		V <sub>CC</sub> = 3.0 V; I <sub>OH</sub> = -20 mA	2.0	-	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>CC</sub> = 2.7 V; I <sub>OL</sub> = -100 μA	-	-	0.2	V
		V <sub>CC</sub> = 2.7 V; I <sub>OL</sub> = 24 mA	-	-	0.5	V
		V <sub>CC</sub> = 3.0 V; I <sub>OL</sub> = 32 mA	-	-	0.5	V
I <sub>I</sub>	input leakage current	V <sub>CC</sub> = 0 V or 3.6 V; V <sub>I</sub> = 5.5 V	-	-	10	μA
		V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND	-	-	±1	μA
I <sub>OFF</sub>	output off current	V <sub>CC</sub> = 0 V; V <sub>I</sub> or V <sub>O</sub> = 0 V to 4.5 V	-	-	±100	μA
I <sub>CCH</sub>	quiescent supply current	V <sub>CC</sub> = 3.6 V; outputs HIGH; V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 V	-	-	0.02	mA
I <sub>CCL</sub>	quiescent supply current	V <sub>CC</sub> = 3.6 V; outputs LOW; V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 V	-	1.5	3	mA
ΔI <sub>CC</sub>	additional supply current	per input pin; V <sub>CC</sub> = 3 V to 3.6 V; one input at V <sub>CC</sub> - 0.6 V; other inputs at V <sub>CC</sub> or GND [2]	-	-	0.2	mA
C <sub>I</sub>	input capacitance	V <sub>I</sub> = 3 V or 0 V	-	3	-	pF

[1] All typical values are at V<sub>CC</sub> = 3.3 V and T<sub>amb</sub> = 25°C.

[2] This is the increase in supply current for each input at the specified voltage level other than V<sub>CC</sub> or GND.

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

GND = 0 V; for test circuit, see Fig. 7.

Symbol	Parameter	Conditions	-40 °C to +85 °C			Unit
			Min	Typ [1]	Max	
t <sub>PLH</sub>	LOW to OFF-state propagation delay	nA to nY; see Fig. 6				
		V <sub>CC</sub> = 2.7 V	-	-	4.7	ns
		V <sub>CC</sub> = 3.3 V ± 0.3 V	1.0	2.6	3.9	ns
t <sub>PHL</sub>	OFF-state to LOW propagation delay	nA to nY; see Fig. 6				ns
		V <sub>CC</sub> = 2.7 V	-	-	3.2	
		V <sub>CC</sub> = 3.3 V ± 0.3 V	1.0	2.5	3.5	ns

[1] All typical values are at V<sub>CC</sub> = 3.3 V and T<sub>amb</sub> = 25°C.

10.1. Waveform and test circuit

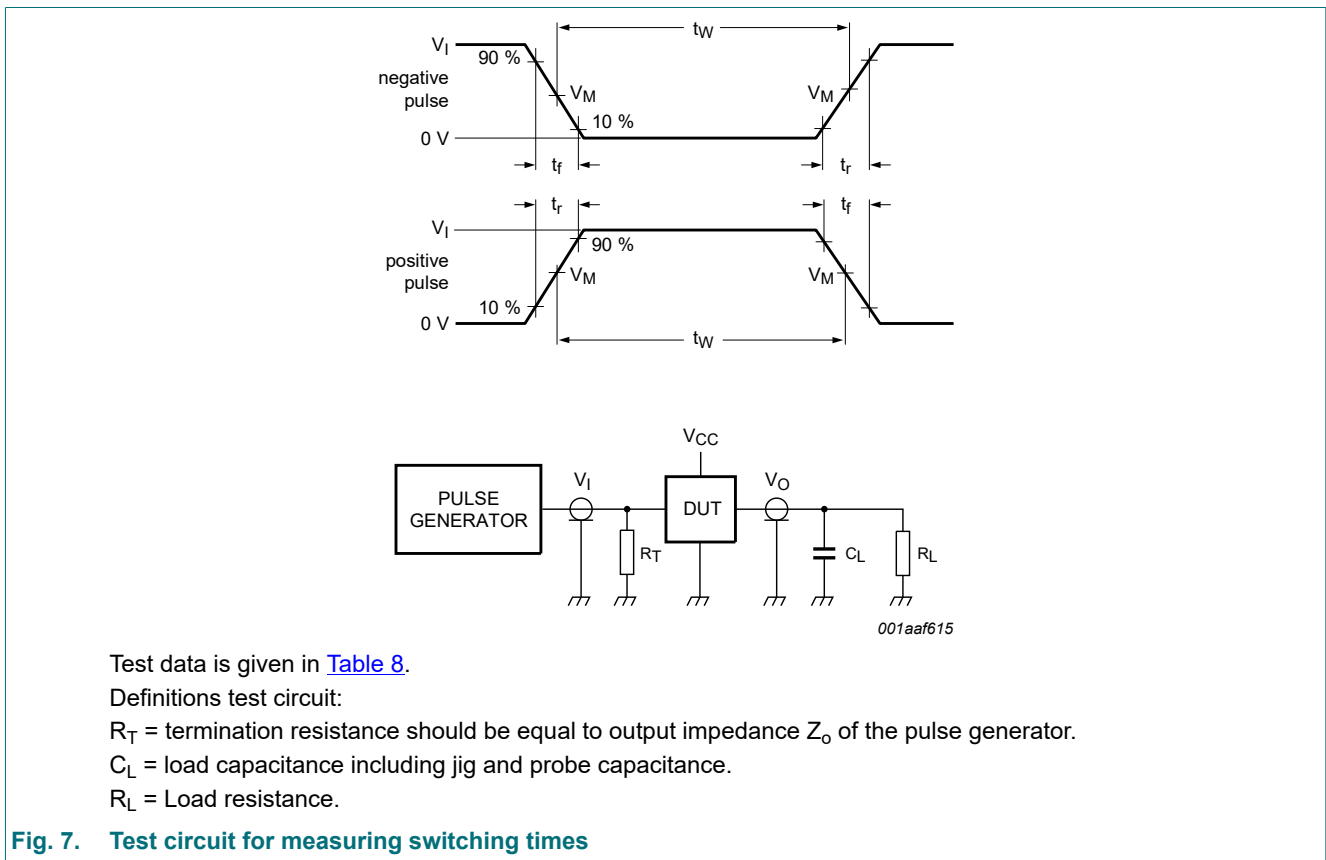
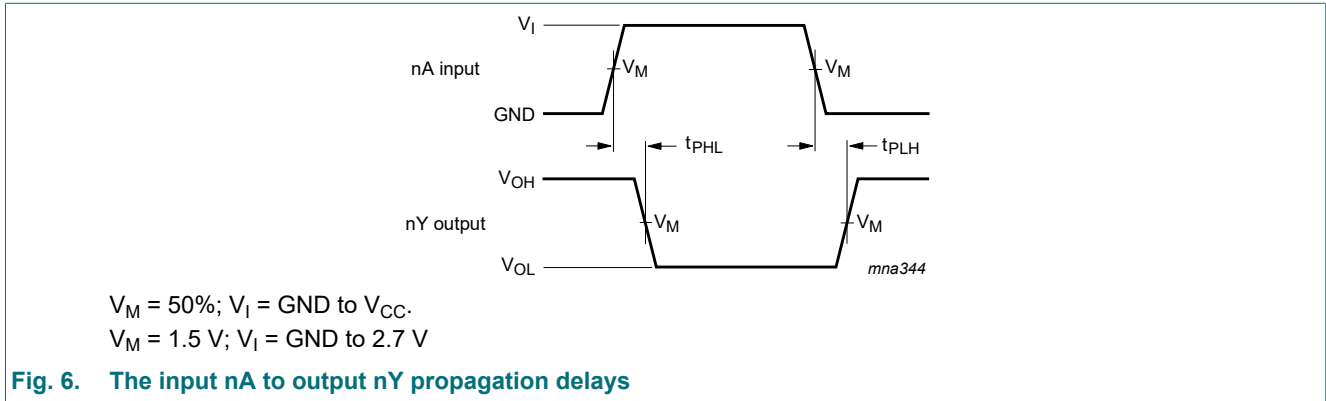


Table 8. Test data

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

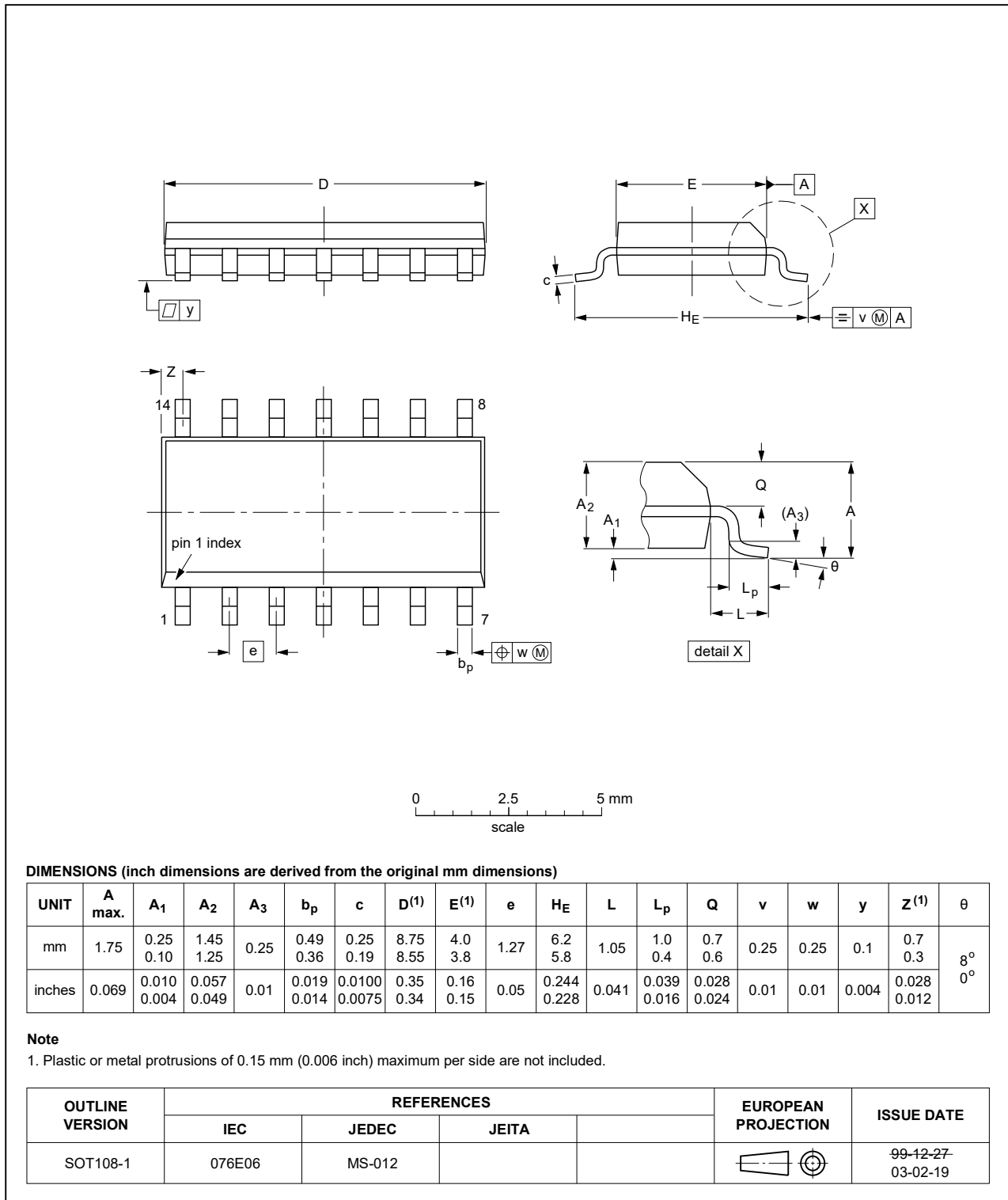


Fig. 8. Package outline SOT108-1 (SO14)

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

SOT402-1

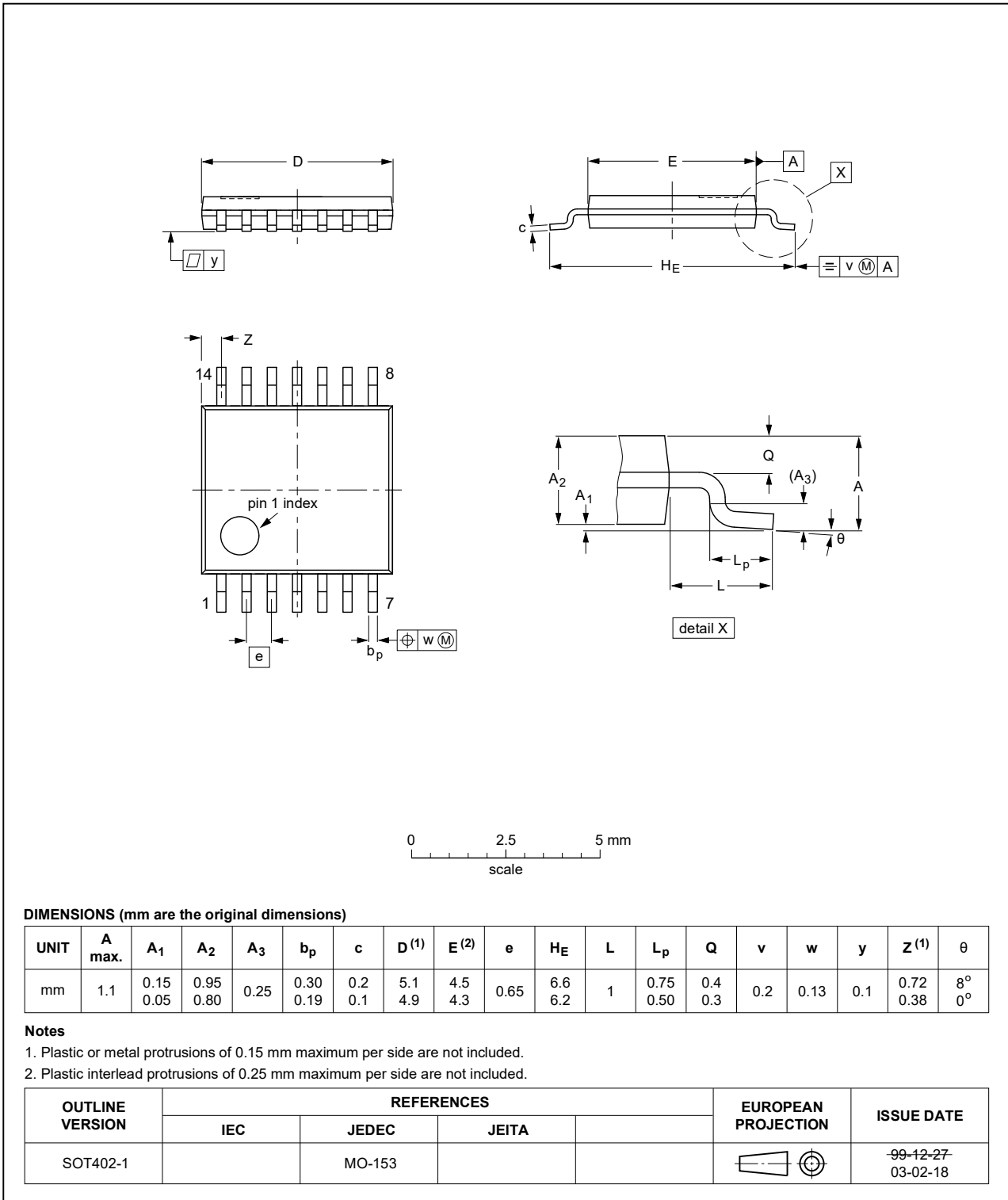


Fig. 9. Package outline SOT402-1 (TSSOP14)

## 12. Abbreviations

Table 9. Abbreviations

Acronym	Description
BiCMOS	Bipolar Complementary Metal Oxide Semiconductor
ESD	ElectroStatic Discharge
HBM	Human Body Model
MIL	Military
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_Q100 v.2	20210401	Product data sheet	-	74LVT04_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="#">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> <li>Type number 74LVT04DB-Q100 (SOT337-1 / SSOP14) removed.</li> </ul>			
74LVT04_Q100 v.1	20140526	Product data sheet	-	-



## 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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