

74LVT04-Q100

3.3 V Hex inverter

Rev. 1 — 26 May 2014

Product data sheet

1. General description

The 74LVT04-Q100 is a high-performance product designed for V_{CC} operation at 3.3 V.

The 74LVT04-Q100 provides six inverting buffers.

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

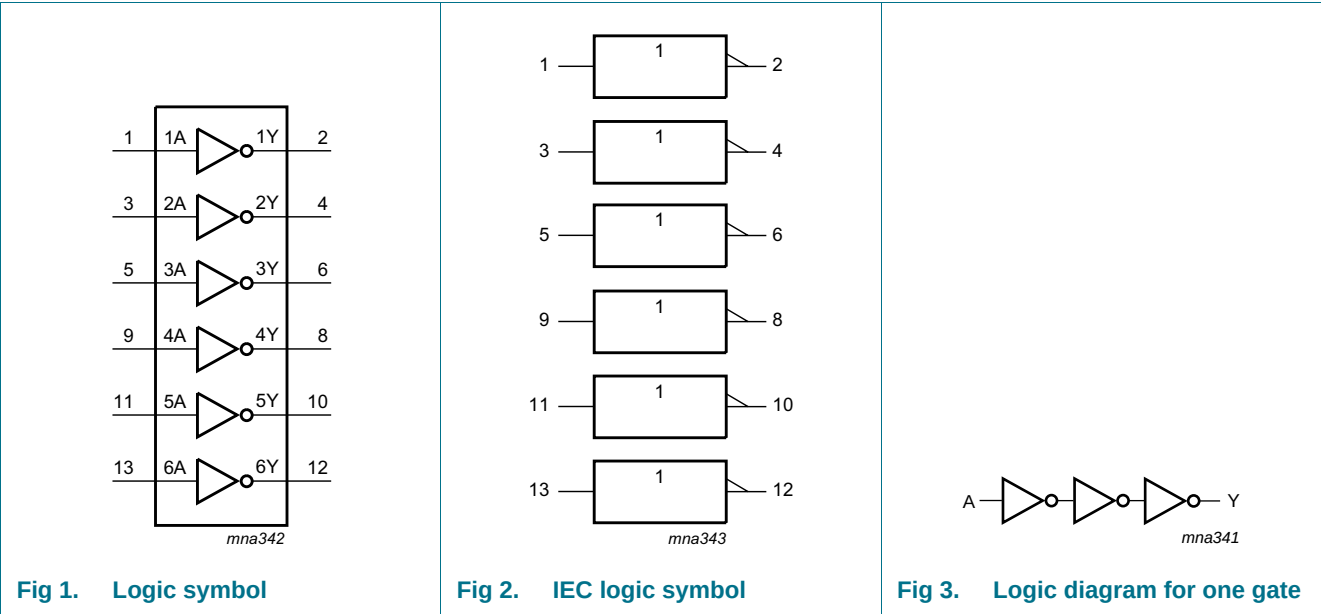
- Automotive product qualification in accordance with AEC-Q100 (Grade 3)
 - ◆ Specified from $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$
- TTL input and output switching levels
- Latch-up protection
 - ◆ JESD78 class II exceeds 500 mA
- ESD protection:
 - ◆ MIL-STD-883, method 3015 exceeds 2000 V
 - ◆ HBM JESD22-A114F exceeds 2000 V
 - ◆ MM JESD22-A115-A exceeds 200 V ($C = 200\text{ pF}$, $R = 0\text{ }\Omega$)
- Specified from $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$

3. Ordering information

Table 1. Ordering information

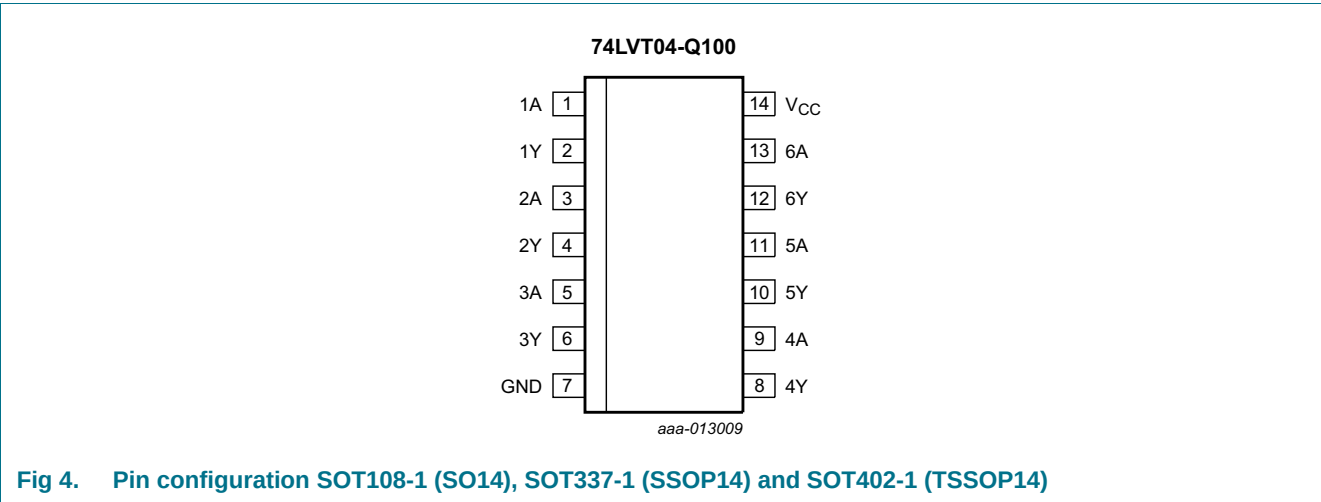
Type number	Package			
	Temperature range	Name	Description	Version
74LVT04D-Q100	$-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1
74LVT04DB-Q100	$-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$	SSOP14	plastic shrink small outline package; 14 leads; body width 5.3 mm	SOT337-1
74LVT04PW-Q100	$-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$	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^[1]

Input	Output
nA	nY
L	H
H	L

[1] H = HIGH voltage level; L = LOW voltage level; Z = high-impedance OFF-state.

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 SO14 packages: above 70 °C derate linearly with 8 mW/K.
For SSOP14 and TSSOP14 packages: above 60 °C derate linearly with 5.5 mW/K.

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 clamping voltage	$V_{CC} = 2.7\text{ V}$; $I_{IK} = -18\text{ mA}$	-	-	-1.2	V
V_{OH}	HIGH-level output voltage	$V_{CC} = 2.7\text{ V to } 3.6\text{ V}$; $I_{OH} = -100\text{ }\mu\text{A}$	$V_{CC} - 0.2$	-	-	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	$V_{CC} = 2.7\text{ V}$; $I_{OL} = -100\text{ }\mu\text{A}$	-	-	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	μA
		$V_{CC} = 3.6\text{ V}$; $V_I = V_{CC}\text{ or GND}$	-	-	± 1	μA
I_{OFF}	power-off leakage current	$V_{CC} = 0\text{ V}$; $V_I\text{ or } V_O = 0\text{ V to } 4.5\text{ V}$	-	-	± 100	μA
I_{CCH}	HIGH-level 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}	LOW-level 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 ^[2] $V_{CC} = 3\text{ V to } 3.6\text{ V}$; one input at $V_{CC} - 0.6\text{ V}$; other inputs at $V_{CC}\text{ or GND}$	-	-	0.2	μA
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 V; for test circuit, see [Figure 6](#).

Symbol	Parameter	Conditions	–40 °C to +85 °C			Unit
			Min	Typ ^[1]	Max	
t _{PLH}	LOW to HIGH propagation delay	nA to nY; see Figure 5				
		V _{CC} = 2.7 V	-	-	4.7	ns
		V _{CC} = 3.3 V ± 0.3 V	1.0	2.6	3.9	ns
t _{PHL}	HIGH to LOW propagation delay	nA to nY; see Figure 5				
		V _{CC} = 2.7 V	-	-	3.2	ns
		V _{CC} = 3.3 V ± 0.3 V	1.0	2.5	3.5	ns

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

11. Waveforms

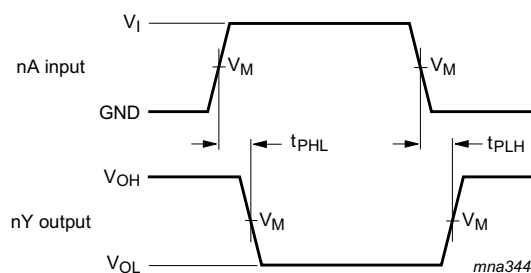
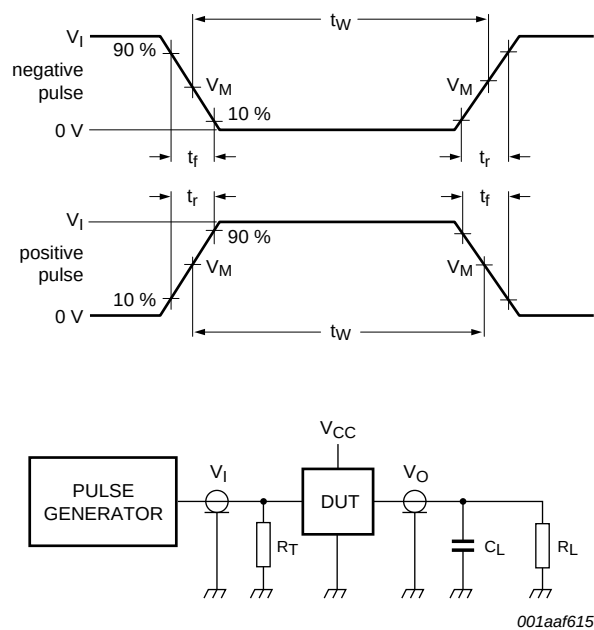

$$V_M = 50\%; V_I = \text{GND to } V_{CC}.$$
 $V_M = 1.5 \text{ V}; V_I = \text{GND to } 2.7 \text{ V}$

Fig 5. The input nA to output nY propagation delays



Test data is given in [Table 8](#).
Definitions test circuit:
 R_T = termination resistance should be equal to output impedance Z_o of the pulse generator.
 C_L = load capacitance including jig and probe capacitance.
 R_L = Load resistance.

Fig 6. Test circuit for measuring switching times

Table 8. Test data

Input				Load	
V_I	f_i	t_W	t_r, t_f	C_L	R_L
2.7 V	≤ 10 MHz	500 ns	≤ 2.5 ns	50 pF	500 Ω

12. Package outline

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

SOT108-1

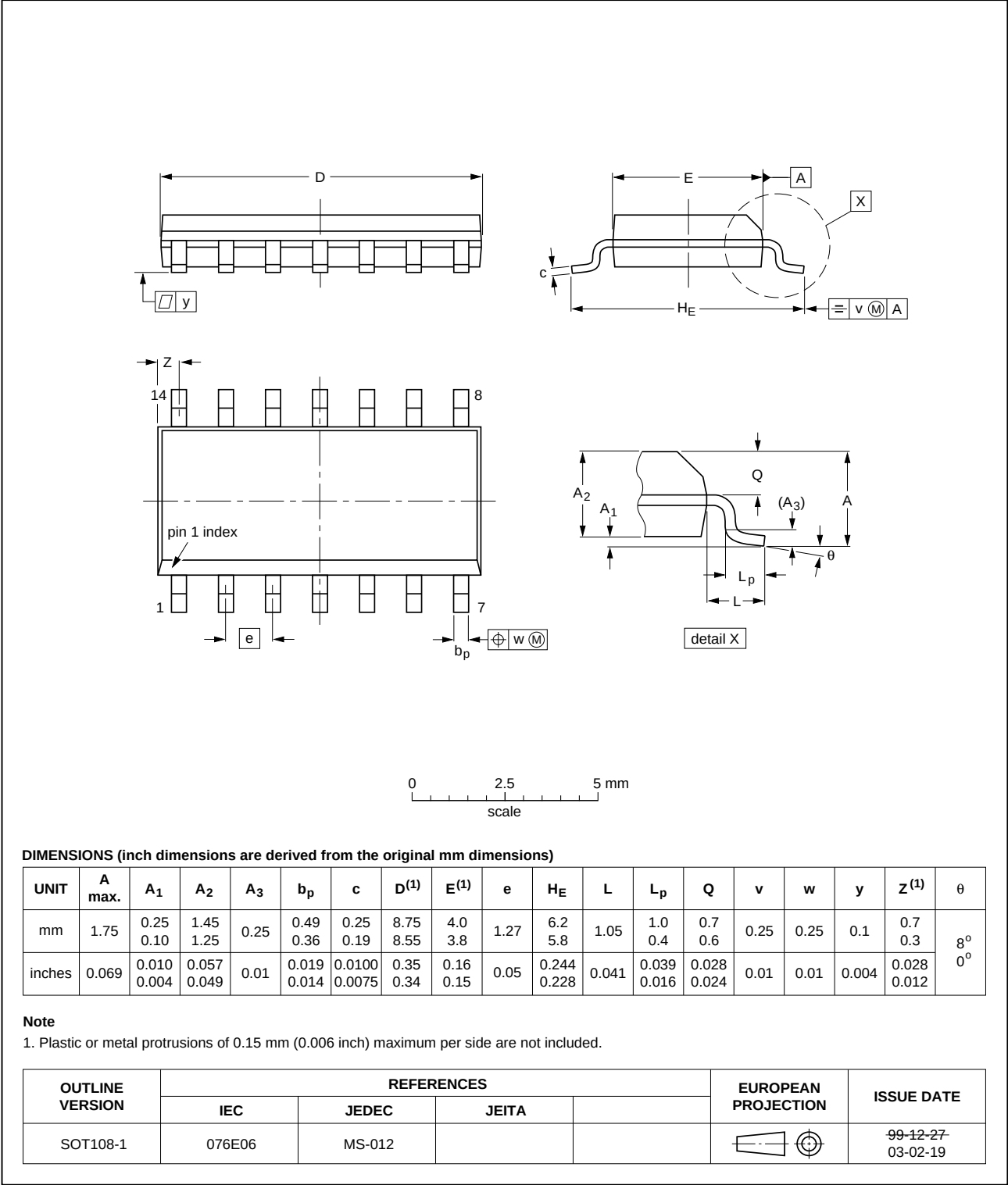


Fig 7. Package outline SOT108-1 (SO14)

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

SOT337-1

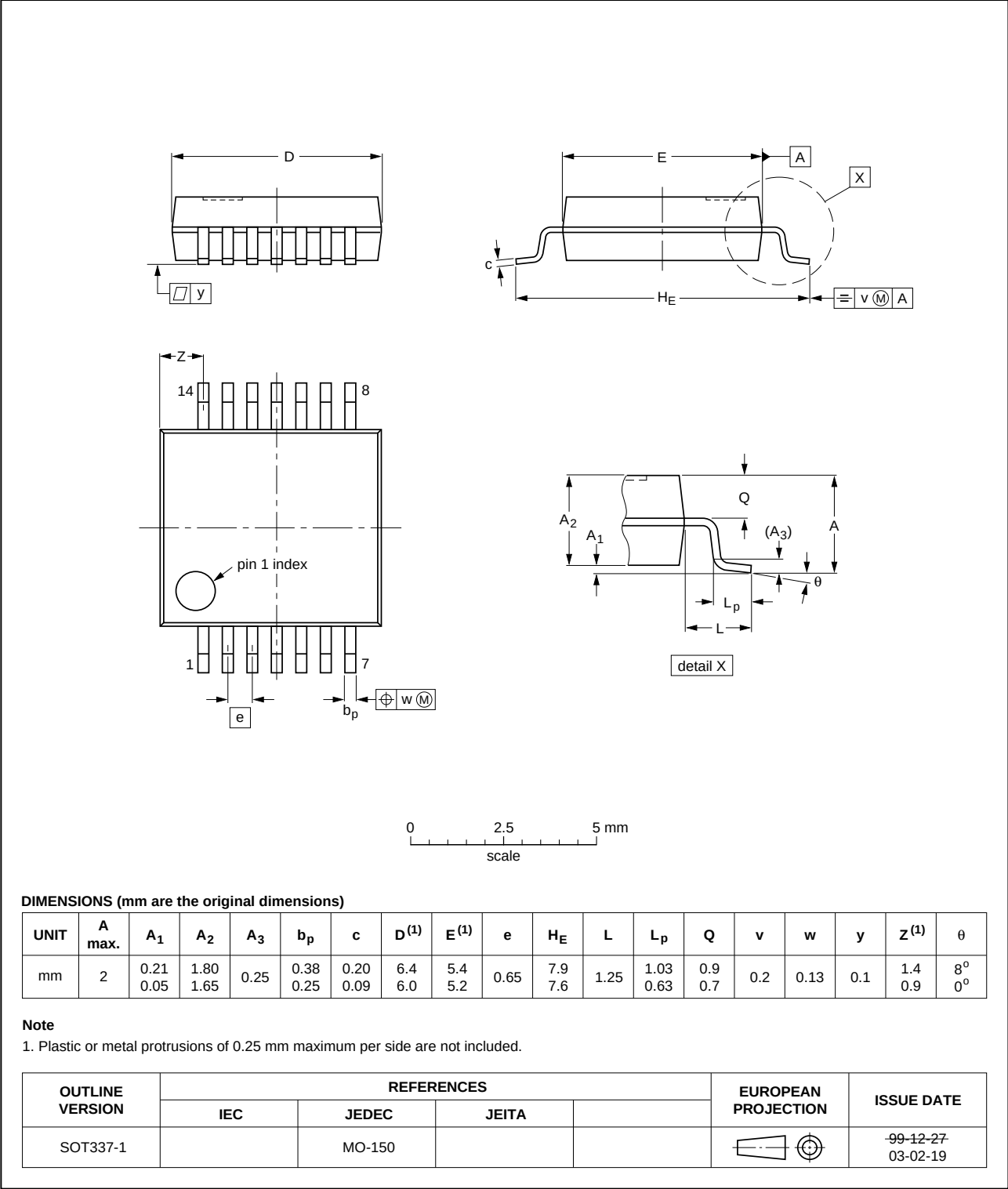


Fig 8. Package outline SOT337-1 (SSOP14)

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

SOT402-1

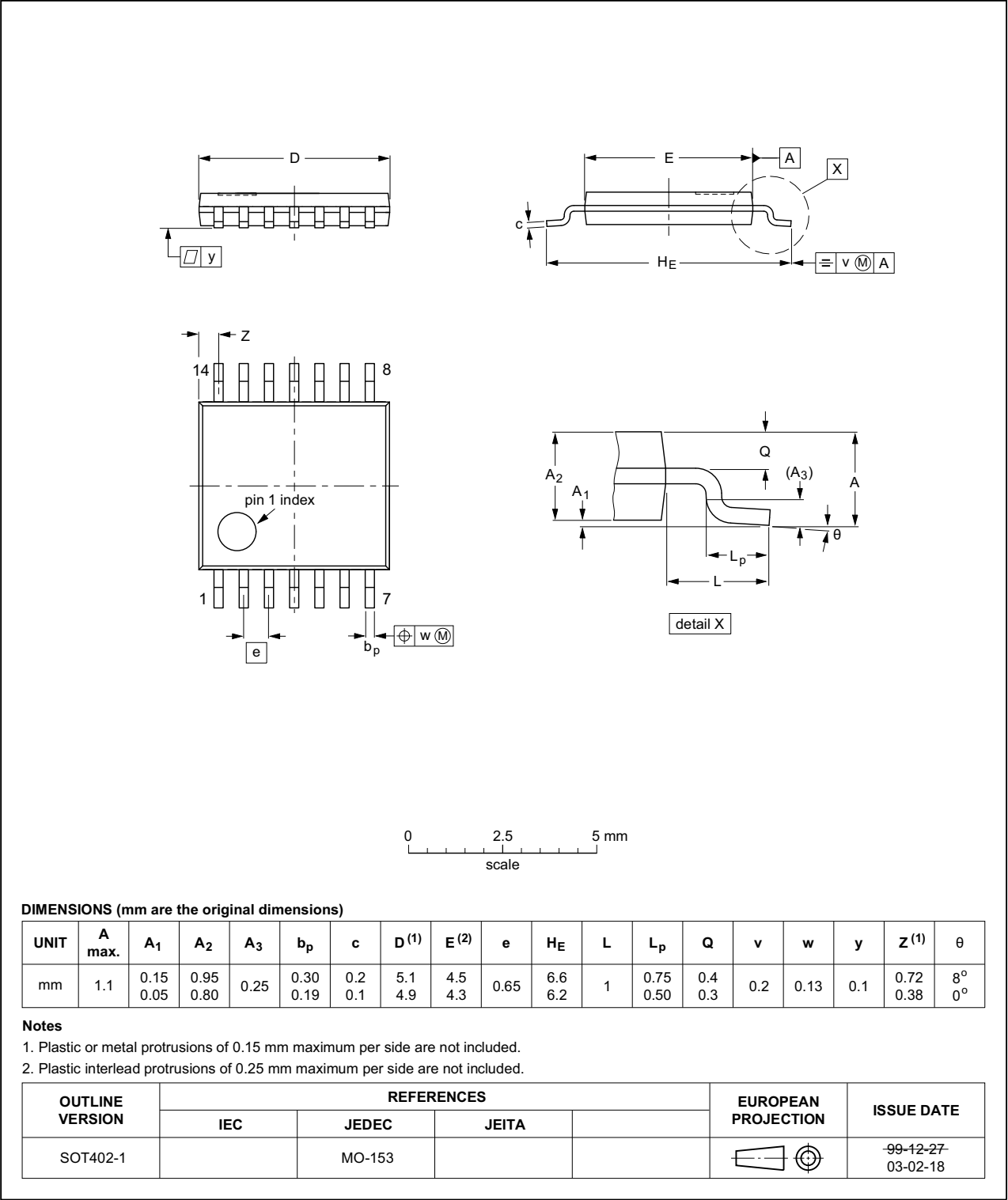


Fig 9. Package outline SOT402-1 (TSSOP14)

13. Abbreviations

Table 9. Abbreviations

Acronym	Description
HBM	Human Body Model
ESD	ElectroStatic Discharge
MM	Machine Model
MIL	Military

14. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVT04_Q100 v.1	20140526	Product data sheet	-	-

15. Legal information

15.1 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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