

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 $+85\text{ }^{\circ}\text{C}$

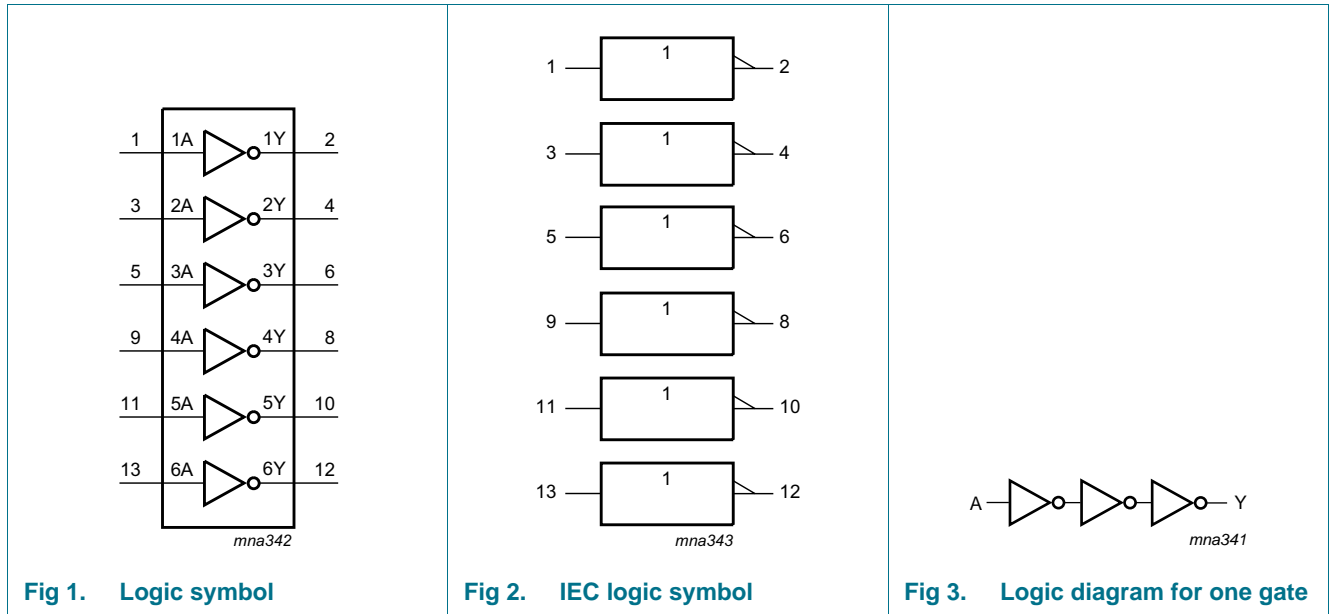
3. Ordering information

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 |

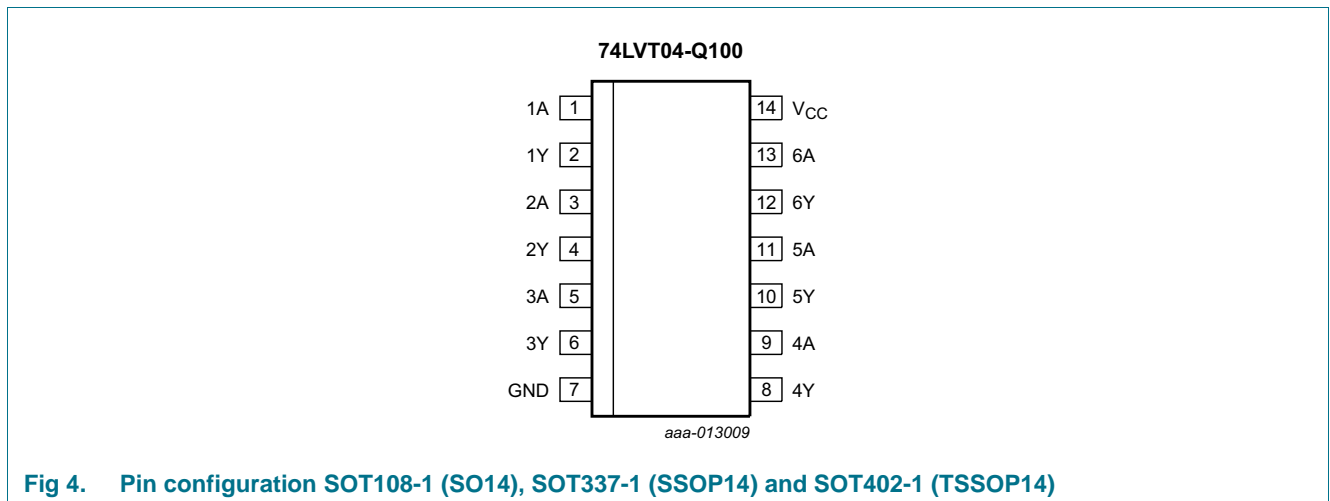


4. Functional diagram



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 $V_{CC} = 3\text{ V to }3.6\text{ V}$; 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.

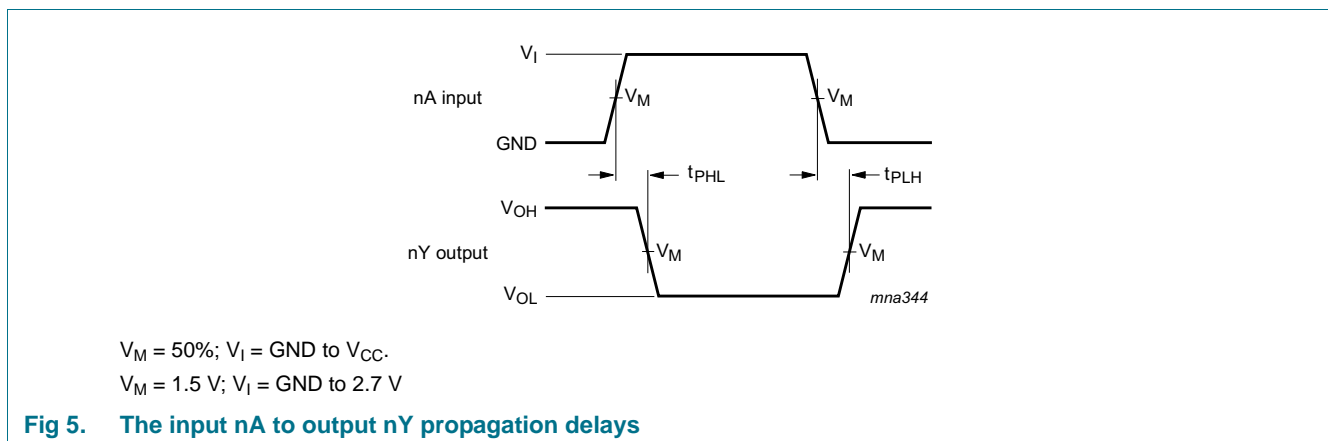
10. Dynamic characteristics

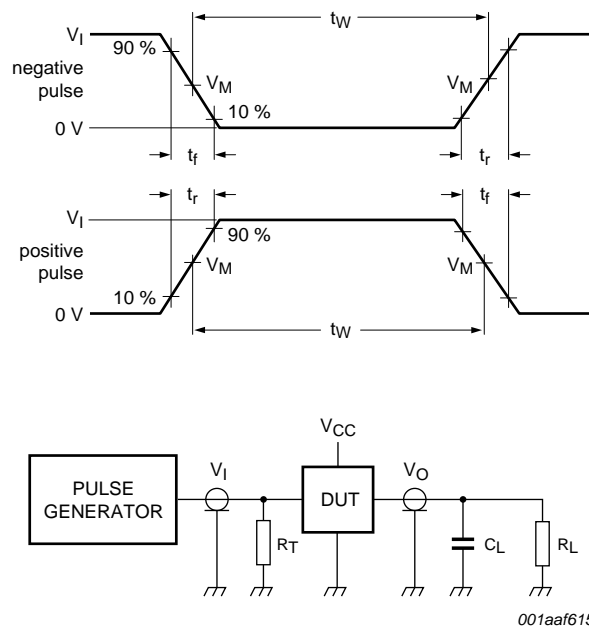
Table 7. Dynamic characteristics
GND = 0 V; for test circuit, see Figure 6.

| 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 V and T_{amb} = 25°C.

11. Waveforms





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

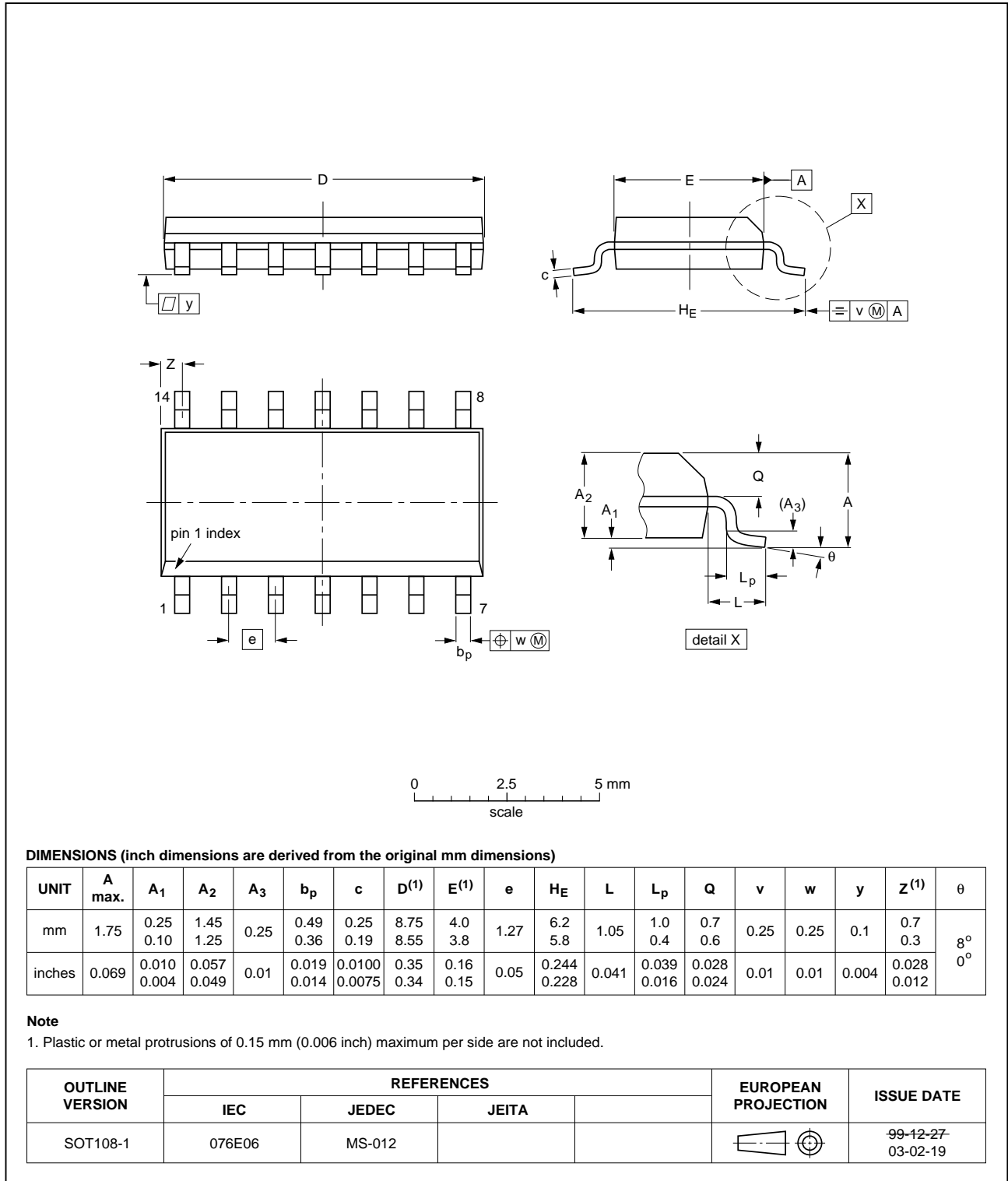


Fig 7. Package outline SOT108-1 (SO14)

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

SOT337-1

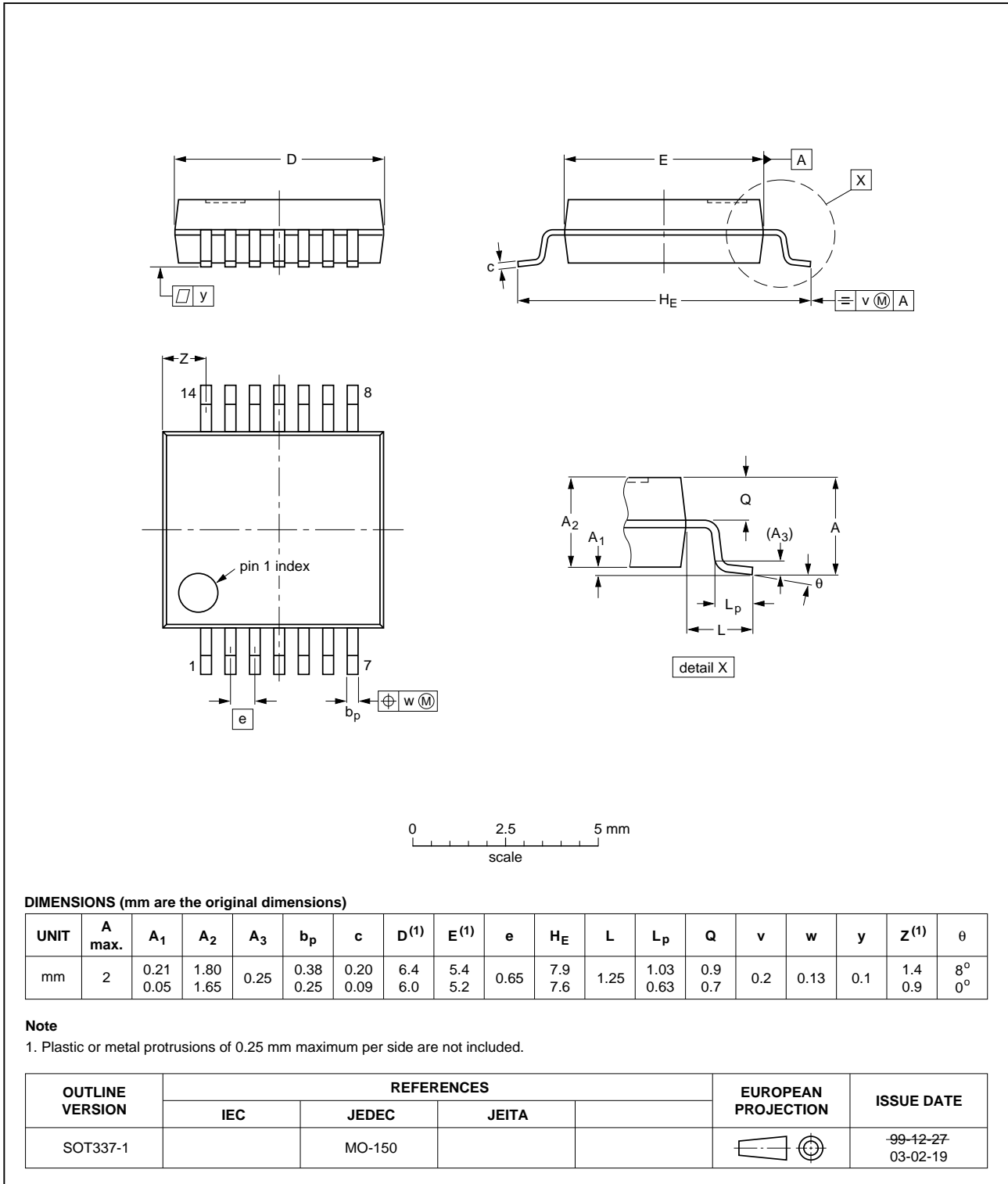


Fig 8. Package outline SOT337-1 (SSOP14)

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. |
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[2] The term 'short data sheet' is explained in section "Definitions".

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