

# 74LV125

## Quad buffer/line driver; 3-state

Rev. 03 — 7 April 2009

Product data sheet

### 1. General description

The 74LV125 is a low-voltage Si-gate CMOS device that is pin and function compatible with 74HC125 and 74HCT125.

The 74LV125 provides four non-inverting buffer/line drivers with 3-state outputs. The 3-state outputs (nY) are controlled by the output enable input ( $\overline{\text{nOE}}$ ). A HIGH at  $\overline{\text{nOE}}$  causes the outputs to assume a high-impedance OFF-state.

### 2. Features

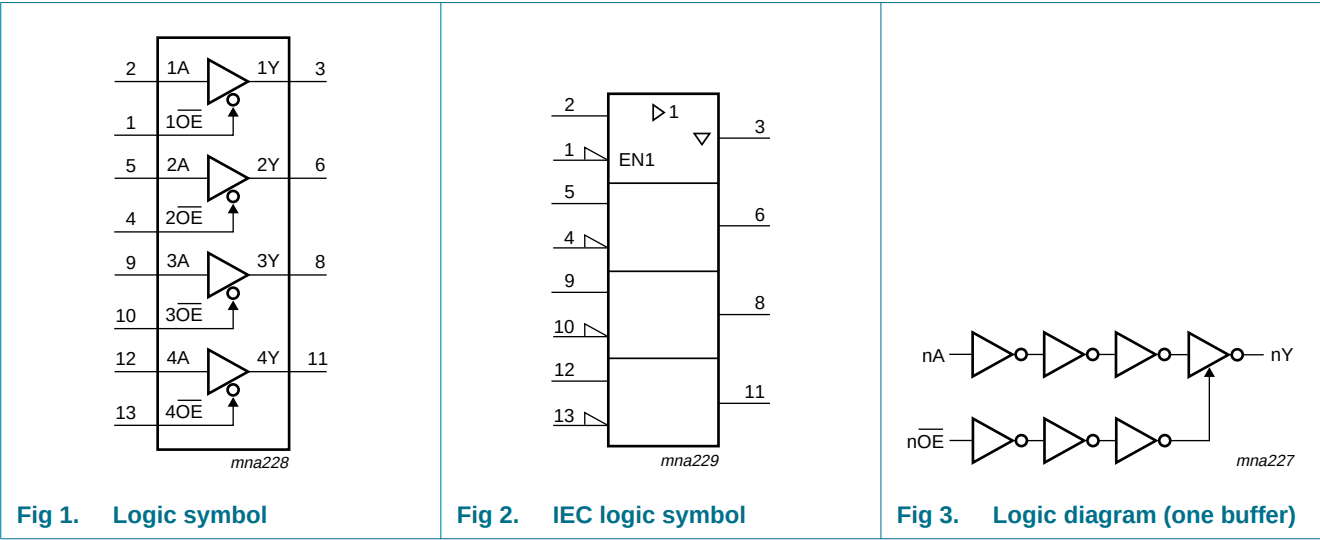
- Wide operating voltage: 1.0 V to 5.5 V
- Optimized for low voltage applications: 1.0 V to 3.6 V
- Accepts TTL input levels between  $V_{CC} = 2.7$  V and  $V_{CC} = 3.6$  V
- Typical output ground bounce  $< 0.8$  V at  $V_{CC} = 3.3$  V and  $T_{amb} = 25$  °C
- Typical HIGH-level output voltage ( $V_{OH}$ ) undershoot:  $> 2$  V at  $V_{CC} = 3.3$  V and  $T_{amb} = 25$  °C
- ESD protection:
  - ◆ HBM JESD22-A114E exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from  $-40$  °C to  $+85$  °C and from  $-40$  °C to  $+125$  °C

### 3. Ordering information

Table 1. Ordering information

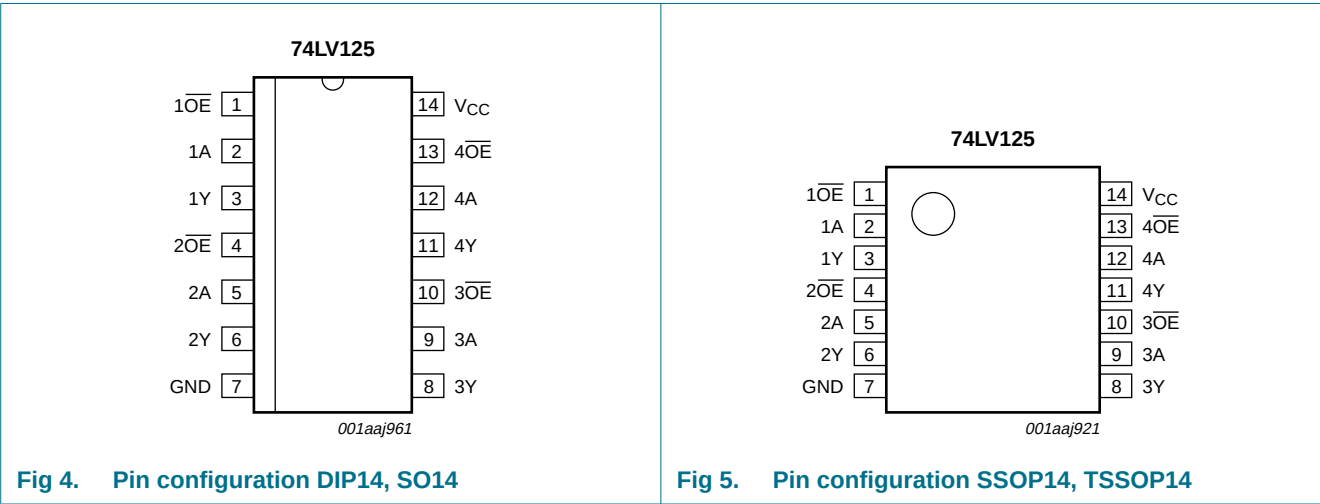
| Type number | Package               |         |                                                                        |          |
|-------------|-----------------------|---------|------------------------------------------------------------------------|----------|
|             | Temperature range     | Name    | Description                                                            | Version  |
| 74LV125N    | $-40$ °C to $+125$ °C | DIP14   | plastic dual in-line package; 14 leads (300 mil)                       | SOT27-1  |
| 74LV125D    | $-40$ °C to $+125$ °C | SO14    | plastic small outline package; 14 leads; body width 3.9 mm             | SOT108-1 |
| 74LV125DB   | $-40$ °C to $+125$ °C | SSOP14  | plastic shrink small outline package; 14 leads; body width 5.3 mm      | SOT337-1 |
| 74LV125PW   | $-40$ °C to $+125$ °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                      |
|-----------------------------------------------------------------------------|--------------|----------------------------------|
| $1\overline{OE}$ , $2\overline{OE}$ , $3\overline{OE}$ , $4\overline{OE}$ , | 1, 4, 10, 13 | output enable input (active LOW) |
| 1A, 2A, 3A, 4A                                                              | 2, 5, 9, 12  | data input                       |
| 1Y, 2Y, 3Y, 4Y                                                              | 3, 6, 8, 11  | data output                      |
| GND                                                                         | 7            | ground (0 V)                     |
| V <sub>CC</sub>                                                             | 14           | supply voltage                   |

## 6. Functional description

**Table 3.** Function table<sup>[1]</sup>

| Control          | Input | Output |
|------------------|-------|--------|
| $\overline{nOE}$ | nA    | nY     |
| L                | L     | L      |
| L                | H     | H      |
| H                | X     | Z      |

[1] H = HIGH voltage level; L = LOW voltage level; X = don't care; 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 <sub>CC</sub>  | supply voltage          |                                                        | -0.5             | +7.0 | V    |
| I <sub>IK</sub>  | input clamping current  | $V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$ | <sup>[1]</sup> - | ±20  | mA   |
| I <sub>OK</sub>  | output clamping current | $V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ | <sup>[1]</sup> - | ±50  | mA   |
| I <sub>O</sub>   | output current          | $V_O = -0.5\text{ V}$ to $(V_{CC} + 0.5\text{ V})$     | -                | ±35  | mA   |
| I <sub>CC</sub>  | supply current          |                                                        | -                | 70   | mA   |
| I <sub>GND</sub> | ground current          |                                                        | -70              | -    | mA   |
| T <sub>stg</sub> | storage temperature     |                                                        | -65              | +150 | °C   |
| P <sub>tot</sub> | total power dissipation | T <sub>amb</sub> = -40 °C to +125 °C                   | <sup>[2]</sup>   |      |      |
|                  |                         | DIP14                                                  | -                | 750  | mW   |
|                  |                         | SO14, SSOP14, TSSOP14                                  | -                | 500  | mW   |

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

[2] For DIP14 packages: above 70 °C the value of P<sub>tot</sub> derates linearly with 12 mW/K.  
 For SO14 packages: above 70 °C the value of P<sub>tot</sub> derates linearly with 8 mW/K.  
 For (T)SSOP14 packages: above 60 °C the value of P<sub>tot</sub> derates linearly with 5.5 mW/K.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Voltages are referenced to GND (ground = 0 V).

| Symbol           | Parameter                           | Conditions                       | Min | Typ | Max             | Unit |
|------------------|-------------------------------------|----------------------------------|-----|-----|-----------------|------|
| V <sub>CC</sub>  | supply voltage <sup>[1]</sup>       |                                  | 1.0 | 3.3 | 5.5             | V    |
| V <sub>I</sub>   | input voltage                       |                                  | 0   | -   | V <sub>CC</sub> | V    |
| V <sub>O</sub>   | output voltage                      |                                  | 0   | -   | V <sub>CC</sub> | V    |
| T <sub>amb</sub> | ambient temperature                 |                                  | -40 | +25 | +125            | °C   |
| Δt/ΔV            | input transition rise and fall rate | V <sub>CC</sub> = 1.0 V to 2.0 V | -   | -   | 500             | ns/V |
|                  |                                     | V <sub>CC</sub> = 2.0 V to 2.7 V | -   | -   | 200             | ns/V |
|                  |                                     | V <sub>CC</sub> = 2.7 V to 3.6 V | -   | -   | 100             | ns/V |
|                  |                                     | V <sub>CC</sub> = 3.6 V to 5.5 V | -   | -   | 50              | ns/V |

- [1] The static characteristics are guaranteed from V<sub>CC</sub> = 1.2 V to V<sub>CC</sub> = 5.5 V, but LV devices are guaranteed to function down to V<sub>CC</sub> = 1.0 V (with input levels GND or V<sub>CC</sub>).

## 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   |                    |                    | -40 °C to +125 °C  |                    | Unit |
|-----------------|---------------------------|-----------------------------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|------|
|                 |                           |                                                     | Min                | Typ <sup>[1]</sup> | Max                | Min                | Max                |      |
| V <sub>IH</sub> | HIGH-level input voltage  | V <sub>CC</sub> = 1.2 V                             | 0.9                | -                  | -                  | 0.9                | -                  | V    |
|                 |                           | V <sub>CC</sub> = 2.0 V                             | 1.4                | -                  | -                  | 1.4                | -                  | V    |
|                 |                           | V <sub>CC</sub> = 2.7 V to 3.6 V                    | 2.0                | -                  | -                  | 2.0                | -                  | V    |
|                 |                           | V <sub>CC</sub> = 4.5 V to 5.5 V                    | 0.7V <sub>CC</sub> | -                  | -                  | 0.7V <sub>CC</sub> | -                  | V    |
| V <sub>IL</sub> | LOW-level input voltage   | V <sub>CC</sub> = 1.2 V                             | -                  | -                  | 0.3                | -                  | 0.3                | V    |
|                 |                           | V <sub>CC</sub> = 2.0 V                             | -                  | -                  | 0.6                | -                  | 0.6                | V    |
|                 |                           | V <sub>CC</sub> = 2.7 V to 3.6 V                    | -                  | -                  | 0.8                | -                  | 0.8                | V    |
|                 |                           | V <sub>CC</sub> = 4.5 V to 5.5 V                    | -                  | -                  | 0.3V <sub>CC</sub> | -                  | 0.3V <sub>CC</sub> | V    |
| V <sub>OH</sub> | HIGH-level output voltage | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> |                    |                    |                    |                    |                    |      |
|                 |                           | I <sub>O</sub> = -100 μA; V <sub>CC</sub> = 1.2 V   | -                  | 1.2                | -                  | -                  | -                  | V    |
|                 |                           | I <sub>O</sub> = -100 μA; V <sub>CC</sub> = 2.0 V   | 1.8                | 2.0                | -                  | 1.8                | -                  | V    |
|                 |                           | I <sub>O</sub> = -100 μA; V <sub>CC</sub> = 2.7 V   | 2.5                | 2.7                | -                  | 2.5                | -                  | V    |
|                 |                           | I <sub>O</sub> = -100 μA; V <sub>CC</sub> = 3.0 V   | 2.8                | 3.0                | -                  | 2.8                | -                  | V    |
|                 |                           | I <sub>O</sub> = -100 μA; V <sub>CC</sub> = 4.5 V   | 4.3                | 4.5                | -                  | 4.3                | -                  | V    |
|                 |                           | I <sub>O</sub> = -8 mA; V <sub>CC</sub> = 3.0 V     | 2.4                | 2.82               | -                  | 2.2                | -                  | V    |
|                 |                           | I <sub>O</sub> = -16 mA; V <sub>CC</sub> = 4.5 V    | 3.6                | 4.2                | -                  | 3.5                | -                  | V    |

**Table 6. Static characteristics ...continued**

At recommended operating conditions. Voltages are referenced to GND (ground = 0 V).

| Symbol           | Parameter                 | Conditions                                                                                                                   | –40 °C to +85 °C |                    |      | –40 °C to +125 °C |      | Unit |
|------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------|------------------|--------------------|------|-------------------|------|------|
|                  |                           |                                                                                                                              | Min              | Typ <sup>[1]</sup> | Max  | Min               | Max  |      |
| V <sub>OL</sub>  | LOW-level output voltage  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                                                          |                  |                    |      |                   |      |      |
|                  |                           | I <sub>O</sub> = 100 µA; V <sub>CC</sub> = 1.2 V                                                                             | -                | 0                  | -    | -                 | -    | V    |
|                  |                           | I <sub>O</sub> = 100 µA; V <sub>CC</sub> = 2.0 V                                                                             | -                | 0                  | 0.2  | -                 | 0.2  | V    |
|                  |                           | I <sub>O</sub> = 100 µA; V <sub>CC</sub> = 2.7 V                                                                             | -                | 0                  | 0.2  | -                 | 0.2  | V    |
|                  |                           | I <sub>O</sub> = 100 µA; V <sub>CC</sub> = 3.0 V                                                                             | -                | 0                  | 0.2  | -                 | 0.2  | V    |
|                  |                           | I <sub>O</sub> = 100 µA; V <sub>CC</sub> = 4.5 V                                                                             | -                | 0                  | 0.2  | -                 | 0.2  | V    |
|                  |                           | I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 3.0 V                                                                               | -                | 0.20               | 0.40 | -                 | 0.50 | V    |
|                  |                           | I <sub>O</sub> = 16 mA; V <sub>CC</sub> = 4.5 V                                                                              | -                | 0.35               | 0.55 | -                 | 0.65 | V    |
| I <sub>I</sub>   | input leakage current     | V <sub>I</sub> = V <sub>CC</sub> or GND;<br>V <sub>CC</sub> = 5.5 V                                                          | -                | -                  | 1.0  | -                 | 1.0  | µA   |
| I <sub>OZ</sub>  | OFF-state output current  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;<br>V <sub>O</sub> = V <sub>CC</sub> or GND;<br>V <sub>CC</sub> = 5.5 V | -                | -                  | 5    | -                 | 10   | µA   |
| I <sub>CC</sub>  | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A;<br>V <sub>CC</sub> = 5.5 V                                    | -                | -                  | 20   | -                 | 160  | µA   |
| ΔI <sub>CC</sub> | additional supply current | per input; V <sub>I</sub> = V <sub>CC</sub> – 0.6 V;<br>V <sub>CC</sub> = 2.7 V to 3.6 V                                     | -                | -                  | 500  | -                 | 850  | µA   |
| C <sub>I</sub>   | input capacitance         |                                                                                                                              | -                | 3.5                | -    | -                 | -    | pF   |

[1] Typical values are measured at T<sub>amb</sub> = 25 °C.

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**Voltages are referenced to GND (ground = 0 V). For test circuit see [Figure 8](#).

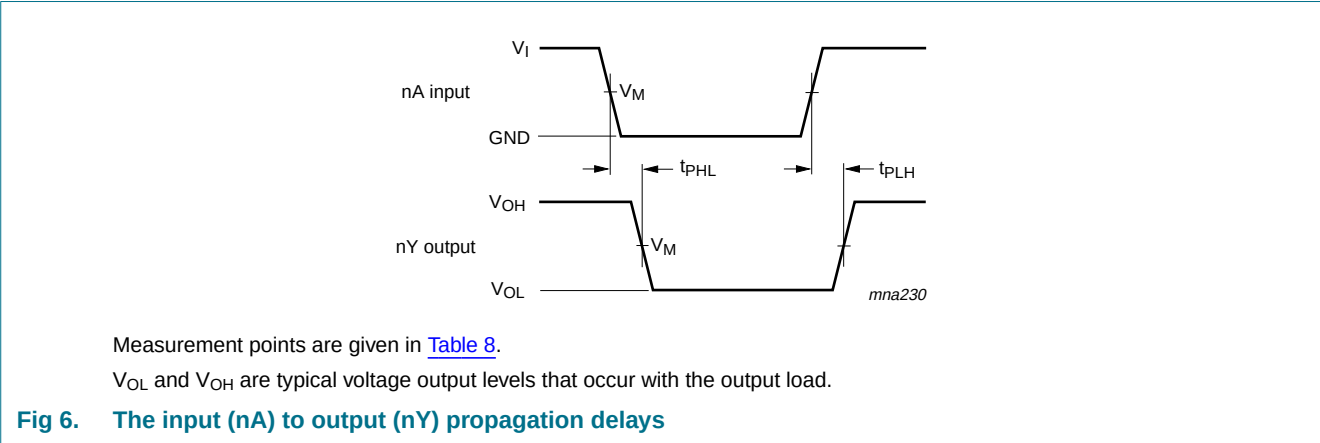
| Symbol          | Parameter         | Conditions                                                              | –40 °C to +85 °C |                    |     | –40 °C to +125 °C |     | Unit |
|-----------------|-------------------|-------------------------------------------------------------------------|------------------|--------------------|-----|-------------------|-----|------|
|                 |                   |                                                                         | Min              | Typ <sup>[1]</sup> | Max | Min               | Max |      |
| t <sub>pd</sub> | propagation delay | nA to nY; see <a href="#">Figure 6</a> <sup>[2]</sup>                   |                  |                    |     |                   |     |      |
|                 |                   | V <sub>CC</sub> = 1.2 V                                                 | -                | 55                 | -   | -                 | -   | ns   |
|                 |                   | V <sub>CC</sub> = 2.0 V                                                 | -                | 19                 | 24  | -                 | 31  | ns   |
|                 |                   | V <sub>CC</sub> = 2.7 V                                                 | -                | 14                 | 18  | -                 | 23  | ns   |
|                 |                   | V <sub>CC</sub> = 3.0 V to 3.6 V; C <sub>L</sub> = 15 pF <sup>[3]</sup> | -                | 9                  | -   | -                 | -   | ns   |
|                 |                   | V <sub>CC</sub> = 3.0 V to 3.6 V <sup>[3]</sup>                         | -                | 10                 | 14  | -                 | 18  | ns   |
|                 |                   | V <sub>CC</sub> = 4.5 V to 5.5 V                                        | -                | -                  | 12  | -                 | 15  | ns   |
| t <sub>en</sub> | enable time       | nOE to nY; see <a href="#">Figure 7</a> <sup>[2]</sup>                  |                  |                    |     |                   |     |      |
|                 |                   | V <sub>CC</sub> = 1.2 V                                                 | -                | 75                 | -   | -                 | -   | ns   |
|                 |                   | V <sub>CC</sub> = 2.0 V                                                 | -                | 26                 | 31  | -                 | 39  | ns   |
|                 |                   | V <sub>CC</sub> = 2.7 V                                                 | -                | 19                 | 23  | -                 | 29  | ns   |
|                 |                   | V <sub>CC</sub> = 3.0 V to 3.6 V <sup>[3]</sup>                         | -                | 14                 | 18  | -                 | 23  | ns   |
|                 |                   | V <sub>CC</sub> = 4.5 V to 5.5 V                                        | -                | -                  | 15  | -                 | 19  | ns   |

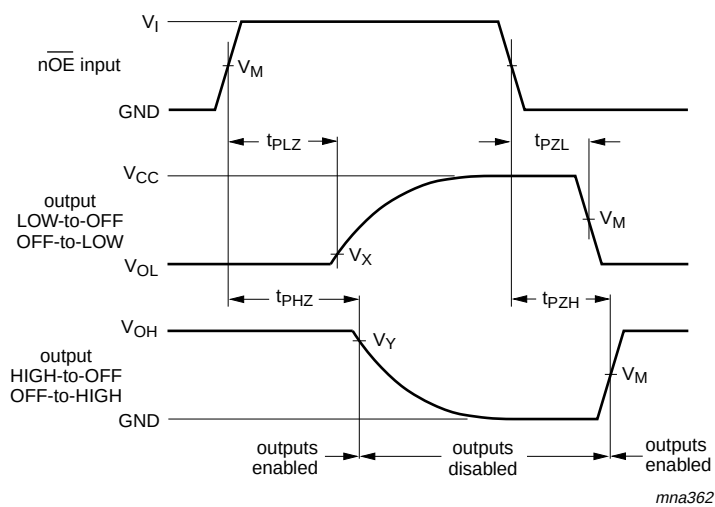
**Table 7. Dynamic characteristics ...continued**  
Voltages are referenced to GND (ground = 0 V). For test circuit see [Figure 8](#).

| Symbol           | Parameter                     | Conditions                                                                                                                          | −40 °C to +85 °C |                    |     | −40 °C to +125 °C |     | Unit |
|------------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|------------------|--------------------|-----|-------------------|-----|------|
|                  |                               |                                                                                                                                     | Min              | Typ <sup>[1]</sup> | Max | Min               | Max |      |
| t <sub>dis</sub> | disable time                  | nOE to nY; see <a href="#">Figure 7</a> <sup>[2]</sup>                                                                              |                  |                    |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 1.2 V                                                                                                             | -                | 65                 | -   | -                 | -   | ns   |
|                  |                               | V <sub>CC</sub> = 2.0 V                                                                                                             | -                | 24                 | 32  | -                 | 39  | ns   |
|                  |                               | V <sub>CC</sub> = 2.7 V                                                                                                             | -                | 18                 | 24  | -                 | 29  | ns   |
|                  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V <sup>[3]</sup>                                                                                     | -                | 14                 | 20  | -                 | 24  | ns   |
|                  |                               | V <sub>CC</sub> = 4.5 V to 5.5 V                                                                                                    | -                | -                  | 17  | -                 | 21  | ns   |
| C <sub>PD</sub>  | power dissipation capacitance | C <sub>L</sub> = 50 pF; f <sub>i</sub> = 1 MHz; <sup>[4]</sup><br>V <sub>I</sub> = GND to V <sub>CC</sub> ; V <sub>CC</sub> = 3.3 V | -                | 22                 | -   | -                 | -   | pF   |

- [1] All typical values are measured at T<sub>amb</sub> = 25 °C.
- [2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.  
t<sub>en</sub> is the same as t<sub>PZL</sub> and t<sub>PZH</sub>.  
t<sub>dis</sub> is the same as t<sub>PLZ</sub> and t<sub>PHZ</sub>.
- [3] Typical values are measured at nominal supply voltage (V<sub>CC</sub> = 3.3 V).
- [4] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$  where:  
f<sub>i</sub> = input frequency in MHz, f<sub>o</sub> = output frequency in MHz  
C<sub>L</sub> = output load capacitance in pF  
V<sub>CC</sub> = supply voltage in Volts  
N = number of inputs switching  
Σ(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of the outputs.

11. Waveforms



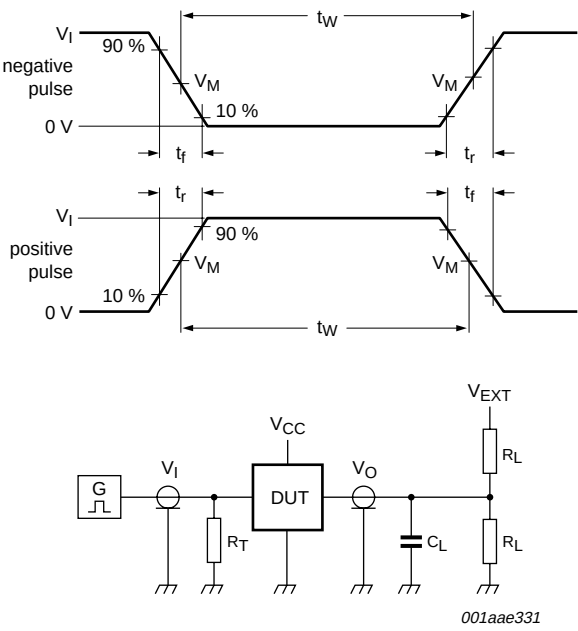


Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.

Fig 7. Enable and disable times

Table 8. Measurement points

| Supply voltage      | Input       | Output      |                         |                         |
|---------------------|-------------|-------------|-------------------------|-------------------------|
| $V_{CC}$            | $V_M$       | $V_M$       | $V_X$                   | $V_Y$                   |
| < 2.7 V             | $0.5V_{CC}$ | $0.5V_{CC}$ | $V_{OL} + 0.1V_{CC}$    | $V_{OH} - 0.1V_{CC}$    |
| 2.7 V to 3.6 V      | 1.5 V       | 1.5 V       | $V_{OL} + 0.3\text{ V}$ | $V_{OH} - 0.3\text{ V}$ |
| $\geq 4.5\text{ V}$ | $0.5V_{CC}$ | $0.5V_{CC}$ | $V_{OL} + 0.1V_{CC}$    | $V_{OH} - 0.1V_{CC}$    |



Test data is given in [Table 9](#).  
Definitions for test circuit:  
 $R_L$  = Load resistance.  
 $C_L$  = Load capacitance including jig and probe capacitance.  
 $R_T$  = Termination resistance should be equal to output impedance  $Z_o$  of the pulse generator.  
 $V_{EXT}$  = External voltage for measuring switching times.

Fig 8. Load circuit for measuring switching times

Table 9. Test data

| Supply voltage  | Input           |                                 | Load           |                | V <sub>EXT</sub>                    |                                     |                                     |
|-----------------|-----------------|---------------------------------|----------------|----------------|-------------------------------------|-------------------------------------|-------------------------------------|
| V <sub>CC</sub> | V <sub>I</sub>  | t <sub>r</sub> , t <sub>f</sub> | C <sub>L</sub> | R <sub>L</sub> | t <sub>PHL</sub> , t <sub>PLH</sub> | t <sub>PZH</sub> , t <sub>PHZ</sub> | t <sub>PZL</sub> , t <sub>PLZ</sub> |
| < 2.7 V         | V <sub>CC</sub> | ≤ 2.5 ns                        | 50 pF          | 1 kΩ           | open                                | GND                                 | 2V <sub>CC</sub>                    |
| 2.7 V to 3.6 V  | 2.7 V           | ≤ 2.5 ns                        | 15 pF, 50 pF   | 1 kΩ           | open                                | GND                                 | 2V <sub>CC</sub>                    |
| ≥ 4.5 V         | V <sub>CC</sub> | ≤ 2.5 ns                        | 50 pF          | 1 kΩ           | open                                | GND                                 | 2V <sub>CC</sub>                    |



12. Package outline

DIP14: plastic dual in-line package; 14 leads (300 mil)

SOT27-1

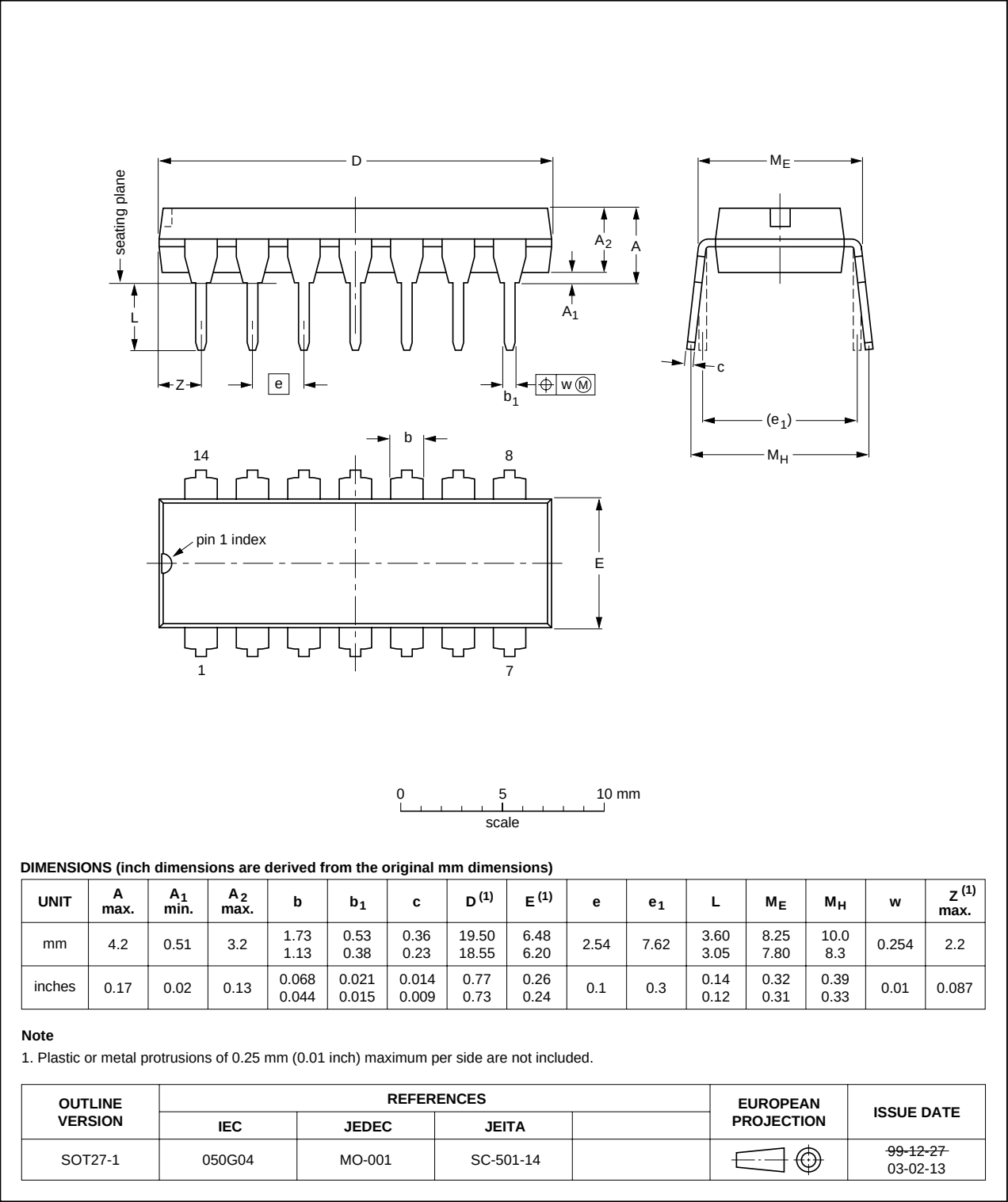


Fig 9. Package outline SOT27-1 (DIP14)

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

SOT108-1

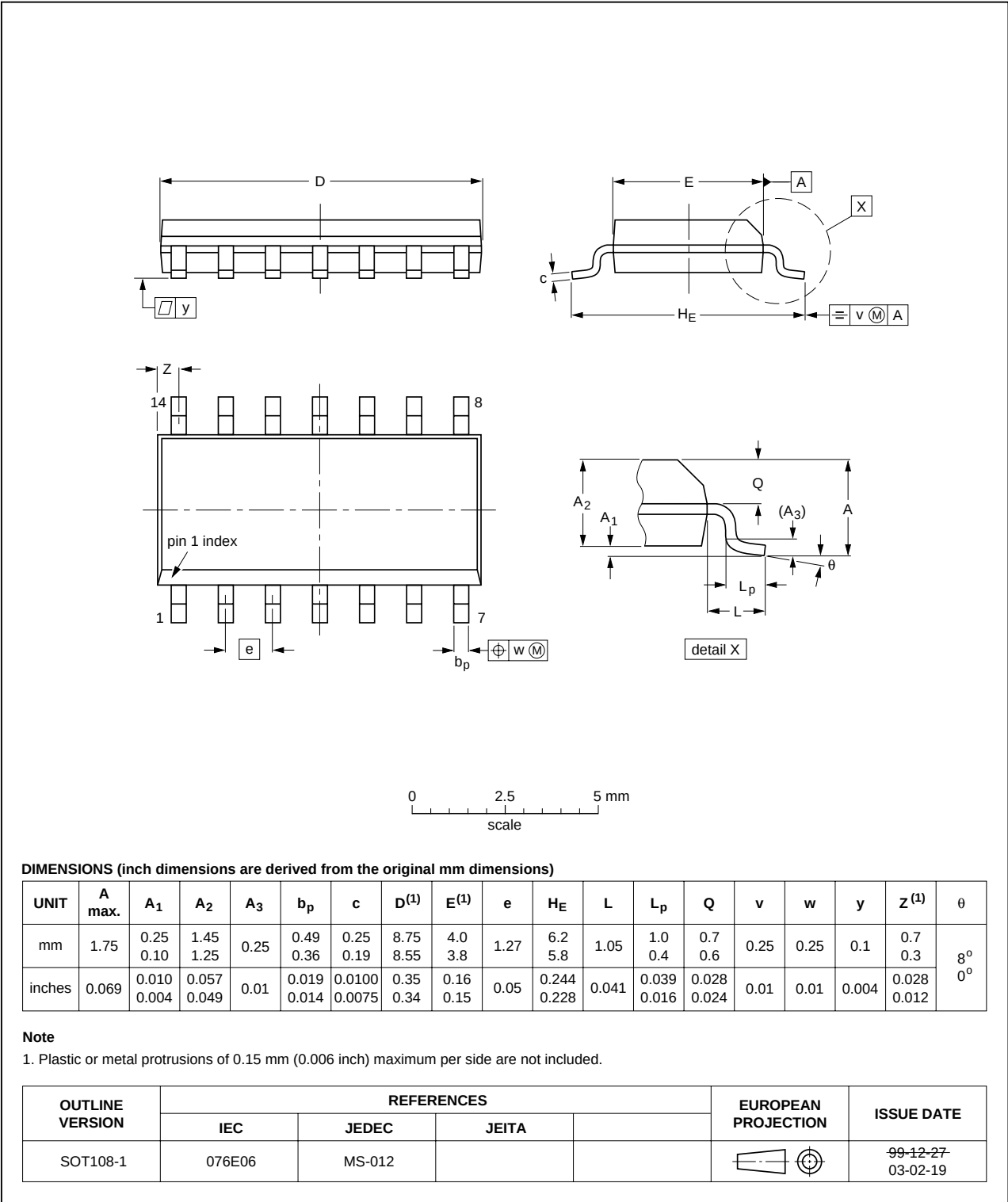


Fig 10. Package outline SOT108-1 (SO14)

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

SOT337-1

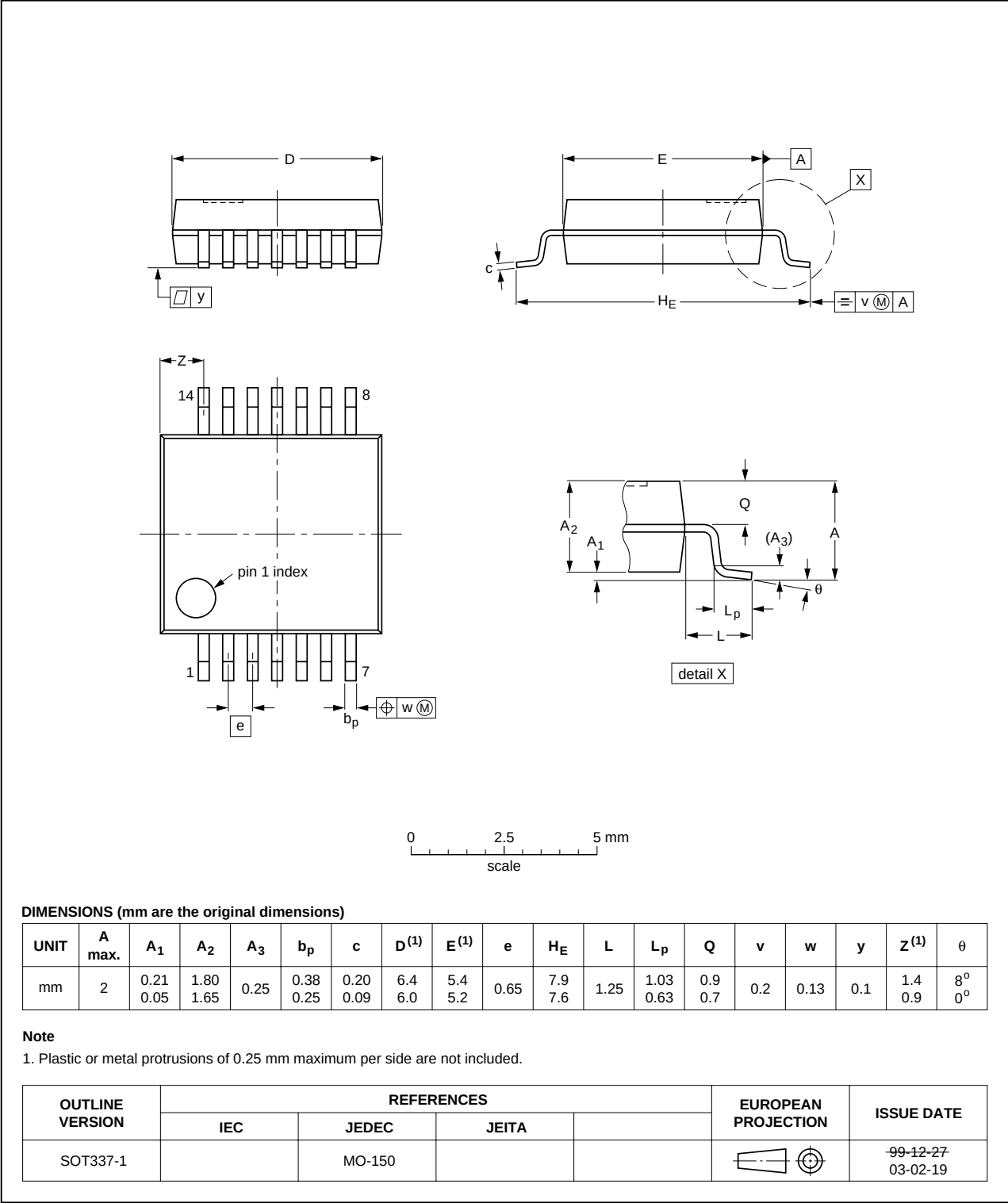


Fig 11. Package outline SOT337-1 (SSOP14)

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

SOT402-1

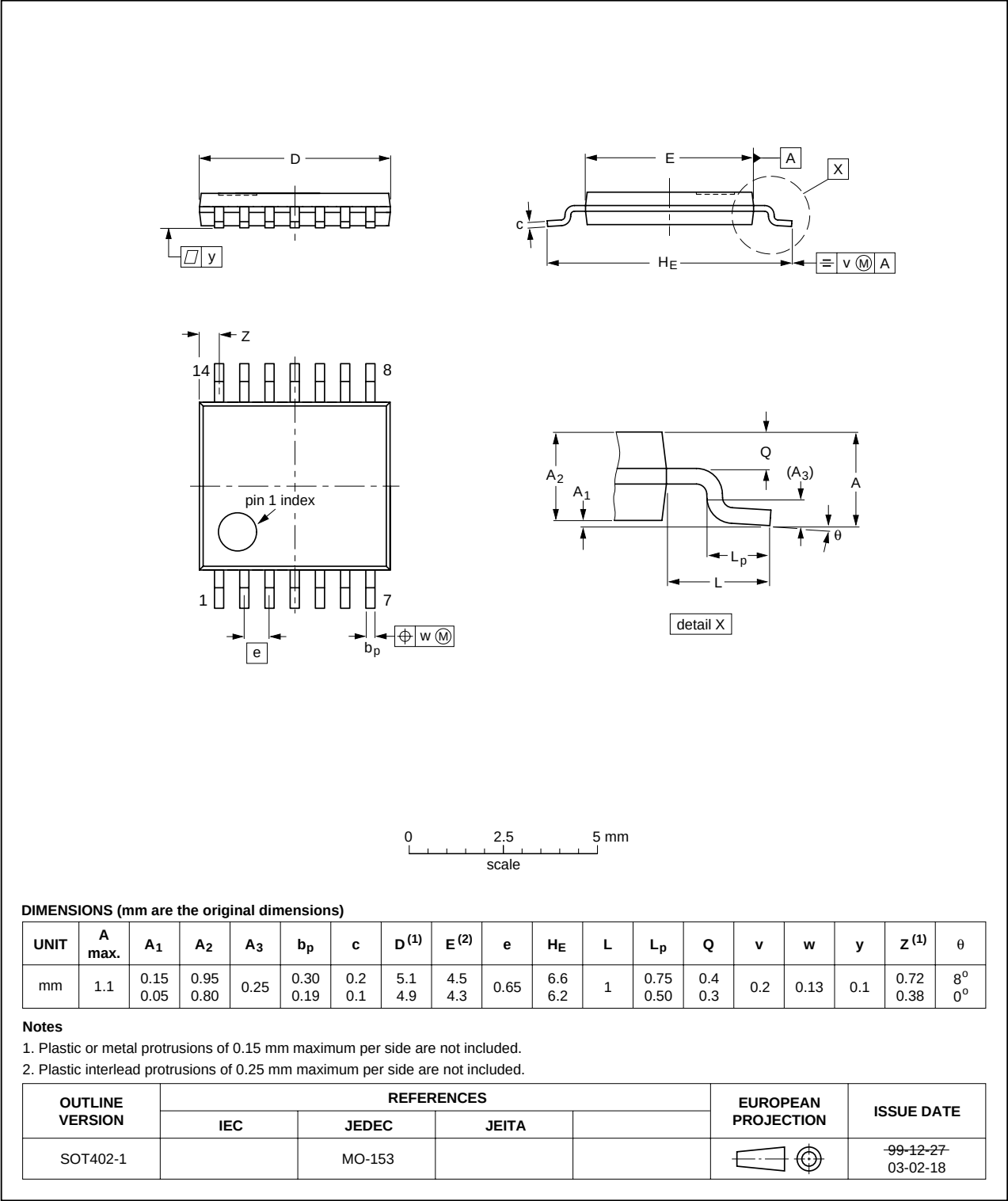


Fig 12. Package outline SOT402-1 (TSSOP14)

13. Abbreviations

Table 10. Abbreviations

| Acronym | Description                             |
|---------|-----------------------------------------|
| CMOS    | Complementary Metal Oxide Semiconductor |
| DUT     | Device Under Test                       |
| ESD     | ElectroStatic Discharge                 |
| HBM     | Human Body Model                        |
| MM      | Machine Model                           |
| TTL     | Transistor-Transistor Logic             |

14. Revision history

Table 11. Revision history

| Document ID    | Release date                                                                                                                                                                                                                                        | Data sheet status     | Change notice | Supersedes |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|------------|
| 74LV125_3      | 20090407                                                                                                                                                                                                                                            | Product data sheet    | -             | 74LV125_2  |
| 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 when appropriate.</li></ul> |                       |               |            |
| 74LV125_2      | 19980428                                                                                                                                                                                                                                            | Product specification | -             | 74LV125_1  |
| 74LV125_1      | 19970203                                                                                                                                                                                                                                            | Product specification | -             | -          |

## 15. Legal information

### 15.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | 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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