

74ALVC125

Quad buffer/line driver; 3-state

Rev. 02 — 10 January 2008

Product data sheet

1. General description

The 74ALVC125 is a quad non-inverting buffer/line driver with 3-state outputs. The 3-state outputs (nY) are controlled by the output enable input (nOE). A HIGH on the nOE pin causes the outputs to assume a high-impedance OFF-state.

2. Features

- Wide supply voltage range from 1.65 V to 3.6 V
- 3.6 V tolerant inputs/outputs
- CMOS low power consumption
- Direct interface with TTL levels (2.7 V to 3.6 V)
- Power-down mode
- Latch-up performance exceeds 250 mA
- Complies with JEDEC standards:
 - ◆ JESD8-7 (1.65 V to 1.95 V)
 - ◆ JESD8-5 (2.3 V to 2.7 V)
 - ◆ JESD8B/JESD36 (2.7 V to 3.6 V)
- ESD protection:
 - ◆ HBM JESD22-A114E exceeds 2000 V
 - ◆ MM JESD22-A 115-A exceeds 200 V

3. Ordering information

Table 1. Ordering information

| Type number | Package | | | Version |
|-------------|-------------------|----------|--|----------|
| | Temperature range | Name | Description | |
| 74ALVC125D | −40 °C to +85 °C | SO14 | plastic small outline package; 14 leads; body width 3.9 mm | SOT108-1 |
| 74ALVC125PW | −40 °C to +85 °C | TSSOP14 | plastic thin shrink small outline package; 14 leads; body width 4.4 mm | SOT402-1 |
| 74ALVC125BQ | −40 °C to +85 °C | DHVQFN14 | plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 × 3 × 0.85 mm | SOT762-1 |

4. Functional diagram

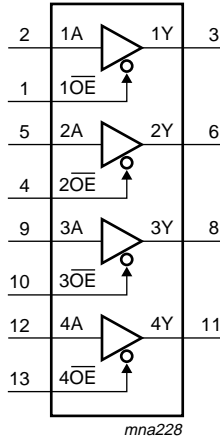


Fig 1. Logic symbol

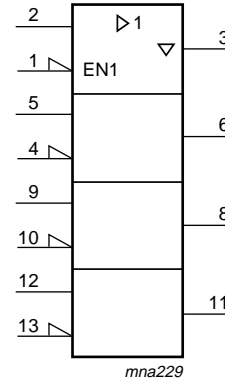


Fig 2. IEC logic symbol

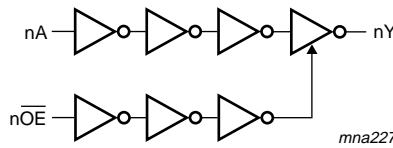


Fig 3. Logic diagram (one buffer)

5. Pinning information

5.1 Pinning

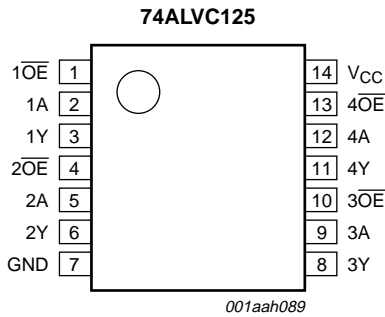
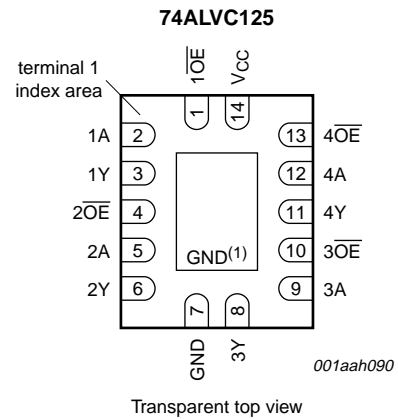


Fig 4. Pin configuration SO14 and TSSOP14



(1) The die substrate is attached to this pad using conductive die attach material. It can not be used as a supply pin or input.

Fig 5. Pin configuration DHVQFN14

5.2 Pin description

Table 2. Pin description

| Symbol | Pin | Description |
|--------------------------|--------------|----------------------------|
| nA | 2, 5, 9, 12 | data input |
| nY | 3, 6, 8, 11 | bus output |
| n $\overline{\text{OE}}$ | 1, 4, 10, 13 | output enable (active LOW) |
| V _{CC} | 14 | supply voltage |
| GND | 7 | ground (0 V) |

6. Functional description

Table 3. Function table^[1]

| Input | | Output | |
|--------------------------|----|--------|--|
| n $\overline{\text{OE}}$ | 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 _{CC} | supply voltage | | -0.5 | +4.6 | V |
| I _{IK} | input clamping current | V _I < 0 V | -50 | - | mA |
| V _I | input voltage | | [1] -0.5 | +4.6 | V |
| I _{OK} | output clamping current | V _O > V _{CC} or V _O < 0 V | - | ±50 | mA |
| V _O | output voltage | output HIGH or LOW state | [1][2] -0.5 | V _{CC} + 0.5 | V |
| | | output 3-state | -0.5 | +4.6 | V |
| | | Power-down mode, V _{CC} = 0 V | [2] -0.5 | +4.6 | V |
| I _O | output current | V _O = 0 V to V _{CC} | - | ±50 | mA |
| I _{CC} | supply current | | - | 100 | mA |
| I _{GND} | ground current | | -100 | - | mA |
| T _{stg} | storage temperature | | -65 | +150 | °C |
| P _{tot} | total power dissipation | T _{amb} = -40 °C to +85 °C | [3] - | 500 | mW |

- [1] The minimum input voltage ratings may be exceeded if the input current ratings are observed.
 [2] When V_{CC} = 0 V (Power-down mode), the output voltage can be 3.6 V in normal operation.
 [3] For SO14 packages: above 70 °C derate linearly with 8 mW/K.
 For TSSOP14 packages: above 60 °C derate linearly with 5.5 mW/K.
 For DHVQFN20 packages: above 60 °C derate linearly with 4.5 mW/K.

8. Recommended operating conditions

Table 5. Recommended operating conditions

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---------------------|-------------------------------------|---------------------------------|------|----------|------|
| V_{CC} | supply voltage | | 1.65 | 3.6 | V |
| V_I | input voltage | | 0 | 3.6 | V |
| V_O | output voltage | output HIGH or LOW state | 0 | V_{CC} | V |
| | | output 3-state | 0 | 3.6 | V |
| | | Power-down mode; $V_{CC} = 0$ V | 0 | 3.6 | V |
| T_{amb} | ambient temperature | in free air | -40 | +85 | °C |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 1.65$ V to 2.7 V | 0 | 20 | ns/V |
| | | $V_{CC} = 2.7$ V to 3.6 V | 0 | 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_{IH} | HIGH-level input voltage | $V_{CC} = 1.65$ V to 1.95 V | $0.65 \times V_{CC}$ | - | - | V |
| | | $V_{CC} = 2.3$ V to 2.7 V | 1.7 | - | - | V |
| | | $V_{CC} = 2.7$ V to 3.6 V | 2.0 | - | - | V |
| V_{IL} | LOW-level input voltage | $V_{CC} = 1.65$ V to 1.95 V | - | - | $0.35 \times V_{CC}$ | V |
| | | $V_{CC} = 2.3$ V to 2.7 V | - | - | 0.7 | V |
| | | $V_{CC} = 2.7$ V to 3.6 V | - | - | 0.8 | V |
| V_{OH} | HIGH-level output voltage | $V_I = V_{IH}$ or V_{IL} | | | | |
| | | $I_O = -100$ μ A; $V_{CC} = 1.65$ V to 3.6 V | $V_{CC} - 0.2$ | - | - | V |
| | | $I_O = -6$ mA; $V_{CC} = 1.65$ V | 1.25 | 1.51 | - | V |
| | | $I_O = -12$ mA; $V_{CC} = 2.3$ V | 1.8 | 2.10 | - | V |
| | | $I_O = -18$ mA; $V_{CC} = 2.3$ V | 1.7 | 2.01 | - | V |
| | | $I_O = -12$ mA; $V_{CC} = 2.7$ V | 2.2 | 2.53 | - | V |
| | | $I_O = -18$ mA; $V_{CC} = 3.0$ V | 2.4 | 2.76 | - | V |
| | | $I_O = -24$ mA; $V_{CC} = 3.0$ V | 2.2 | 2.68 | - | V |
| V_{OL} | LOW-level output voltage | $V_I = V_{IH}$ or V_{IL} | | | | |
| | | $I_O = 100$ μ A; $V_{CC} = 1.65$ V to 3.6 V | - | - | 0.2 | V |
| | | $I_O = 6$ mA; $V_{CC} = 1.65$ V | - | 0.11 | 0.3 | V |
| | | $I_O = 12$ mA; $V_{CC} = 2.3$ V | - | 0.17 | 0.4 | V |
| | | $I_O = 18$ mA; $V_{CC} = 2.3$ V | - | 0.25 | 0.6 | V |
| | | $I_O = 12$ mA; $V_{CC} = 2.7$ V | - | 0.16 | 0.4 | V |
| | | $I_O = 18$ mA; $V_{CC} = 3.0$ V | - | 0.23 | 0.4 | V |
| | | $I_O = 24$ mA; $V_{CC} = 3.0$ V | - | 0.30 | 0.55 | V |
| I_I | input leakage current | $V_{CC} = 3.6$ V; $V_I = 3.6$ V or GND | - | ± 0.1 | ± 5 | μ A |

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 | | | Unit |
|-----------------|---------------------------|---|------------------|--------------------|----------|---------|
| | | | Min | Typ ^[1] | Max | |
| I_{OZ} | OFF-state output current | $V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 1.65$ V to 3.6 V; $V_O = 3.6$ V or GND; | - | ± 0.1 | ± 10 | μ A |
| I_{OFF} | power-off leakage current | $V_{CC} = 0$ V; V_I or $V_O = 0$ V to 3.6 V | - | ± 0.1 | ± 10 | μ A |
| I_{CC} | supply current | $V_{CC} = 3.6$ V; $V_I = V_{CC}$ or GND; $I_O = 0$ A | - | 0.2 | 10 | μ A |
| ΔI_{CC} | additional supply current | per input pin; $V_{CC} = 3.0$ V to 3.6 V; $V_I = V_{CC} - 0.6$ V; $I_O = 0$ A | - | 5 | 750 | μ A |
| C_I | input capacitance | | - | 3.5 | - | pF |

[1] All typical values are measured at $V_{CC} = 3.3$ V (unless stated otherwise) and $T_{amb} = 25$ °C.

10. Dynamic characteristics

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

| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | Unit |
|-----------|-------------------|--|------------------|--------------------|-----|------|
| | | | Min | Typ ^[1] | Max | |
| t_{pd} | propagation delay | nA to nY; see Figure 6 ^[2] | | | | |
| | | $V_{CC} = 1.65$ V to 1.95 V | 1.3 | 2.4 | 5.3 | ns |
| | | $V_{CC} = 2.3$ V to 2.7 V | 1.0 | 1.7 | 3.2 | ns |
| | | $V_{CC} = 2.7$ V | - | 2.0 | 3.1 | ns |
| t_{en} | enable time | $V_{CC} = 3.0$ V to 3.6 V | 1.1 | 1.8 | 2.8 | ns |
| | | n \overline{OE} to nY; see Figure 7 ^[2] | | | | |
| | | $V_{CC} = 1.65$ V to 1.95 V | 1.4 | 3.9 | 6.4 | ns |
| | | $V_{CC} = 2.3$ V to 2.7 V | 1.0 | 2.2 | 4.1 | ns |
| t_{dis} | disable time | $V_{CC} = 2.7$ V | - | 2.7 | 4.3 | ns |
| | | $V_{CC} = 3.0$ V to 3.6 V | 1.0 | 1.9 | 3.5 | ns |
| | | n \overline{OE} to nY; see Figure 7 ^[2] | | | | |
| | | $V_{CC} = 1.65$ V to 1.95 V | 1.8 | 3.9 | 5.9 | ns |
| | | $V_{CC} = 2.3$ V to 2.7 V | 1.0 | 2.1 | 3.4 | ns |
| | | $V_{CC} = 2.7$ V | - | 2.9 | 4.0 | ns |
| | | $V_{CC} = 3.0$ V to 3.6 V | 1.4 | 2.7 | 4.0 | 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 | | | Unit |
|-----------------|-------------------------------|--|------------------|--------------------|-----|------|
| | | | Min | Typ ^[1] | Max | |
| C _{PD} | power dissipation capacitance | per buffer; V _I = GND to V _{CC} ; V _{CC} = 3.3 V ^[3] | | | | |
| | | outputs HIGH or LOW state | - | 27 | - | pF |
| | | outputs 3-state | - | 5 | - | pF |

[1] Typical values are measured at T_{amb} = 25 °C

[2] t_{pd} is the same as t_{PHL} and t_{PLH}.

t_{en} is the same as t_{PZH} and t_{PZL}.

t_{dis} is the same as t_{PHZ} and t_{PLZ}.

[3] C_{PD} is used to determine the dynamic power dissipation (P_D 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_i = input frequency in MHz; f_o = output frequency in MHz

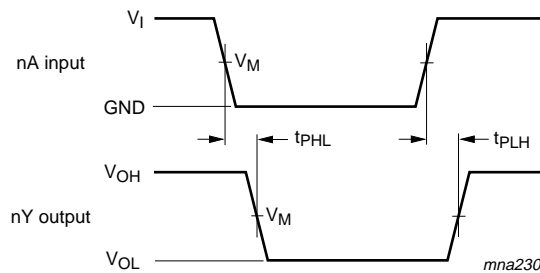
C_L = output load capacitance in pF

V_{CC} = supply voltage in Volts

N = number of inputs switching

Σ(C_L × V_{CC}² × f_o) = sum of the outputs

11. Waveforms



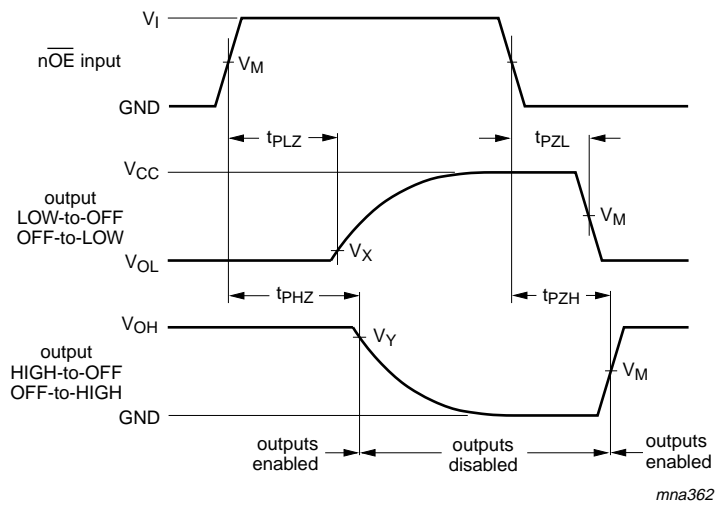
Measurement points are given in [Table 8](#).

V_{OL} and V_{OH} are the typical output voltage levels that occur with the output load.

Fig 6. Input nA to output nY propagation delay times

Table 8. Measurement points

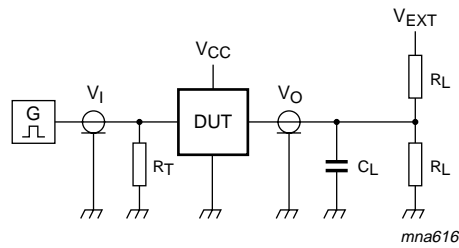
| Supply voltage | Input | Output | | |
|------------------|--------------------|--------------------|--------------------------|--------------------------|
| V _{CC} | V _M | V _M | V _X | V _Y |
| 1.65 V to 1.95 V | 0.5V _{CC} | 0.5V _{CC} | V _{OL} + 0.15 V | V _{OH} - 0.15 V |
| 2.3 V to 2.7 V | 0.5V _{CC} | 0.5V _{CC} | V _{OL} + 0.15 V | V _{OH} - 0.15 V |
| 2.7 V | 1.5 V | 1.5 V | V _{OL} + 0.3 V | V _{OH} - 0.3 V |
| 3.0 V to 3.6 V | 1.5 V | 1.5 V | V _{OL} + 0.3 V | V _{OH} - 0.3 V |



Measurement points are given in [Table 8](#).

V_{OL} and V_{OH} are the typical output voltage levels that occur with the output load.

Fig 7. Enable and disable times



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. Test circuitry for switching times

Table 9. Test data

| Supply voltage | Input | | Load | | V_{EXT} | | |
|------------------|----------|---------------|-------|--------------|--------------------|--------------------|--------------------|
| | V_I | t_r, t_f | C_L | R_L | t_{PLH}, t_{PHL} | t_{PLZ}, t_{PZL} | t_{PHZ}, t_{PZH} |
| 1.65 V to 1.95 V | V_{CC} | ≤ 2.0 ns | 30 pF | 1 k Ω | open | $2 \times V_{CC}$ | GND |
| 2.3 V to 2.7 V | V_{CC} | ≤ 2.0 ns | 30 pF | 500 Ω | open | $2 \times V_{CC}$ | GND |
| 2.7 V | 2.7 V | ≤ 2.5 ns | 50 pF | 500 Ω | open | 6 V | GND |
| 3.0 V to 3.6 V | 2.7 V | ≤ 2.5 ns | 50 pF | 500 Ω | open | 6 V | GND |

12. Package outline

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

SOT108-1

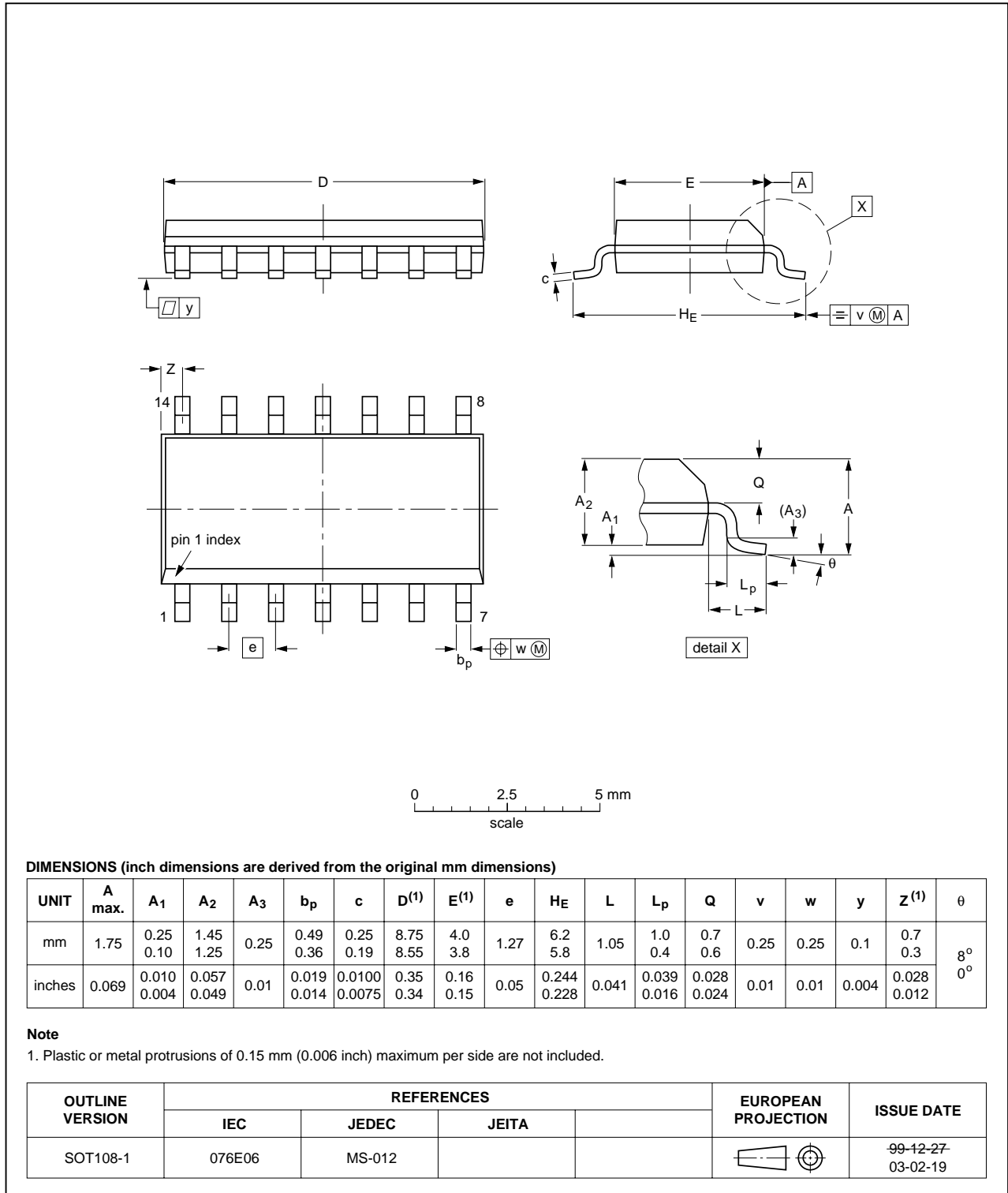


Fig 9. Package outline SOT108-1 (SO14)

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

SOT402-1

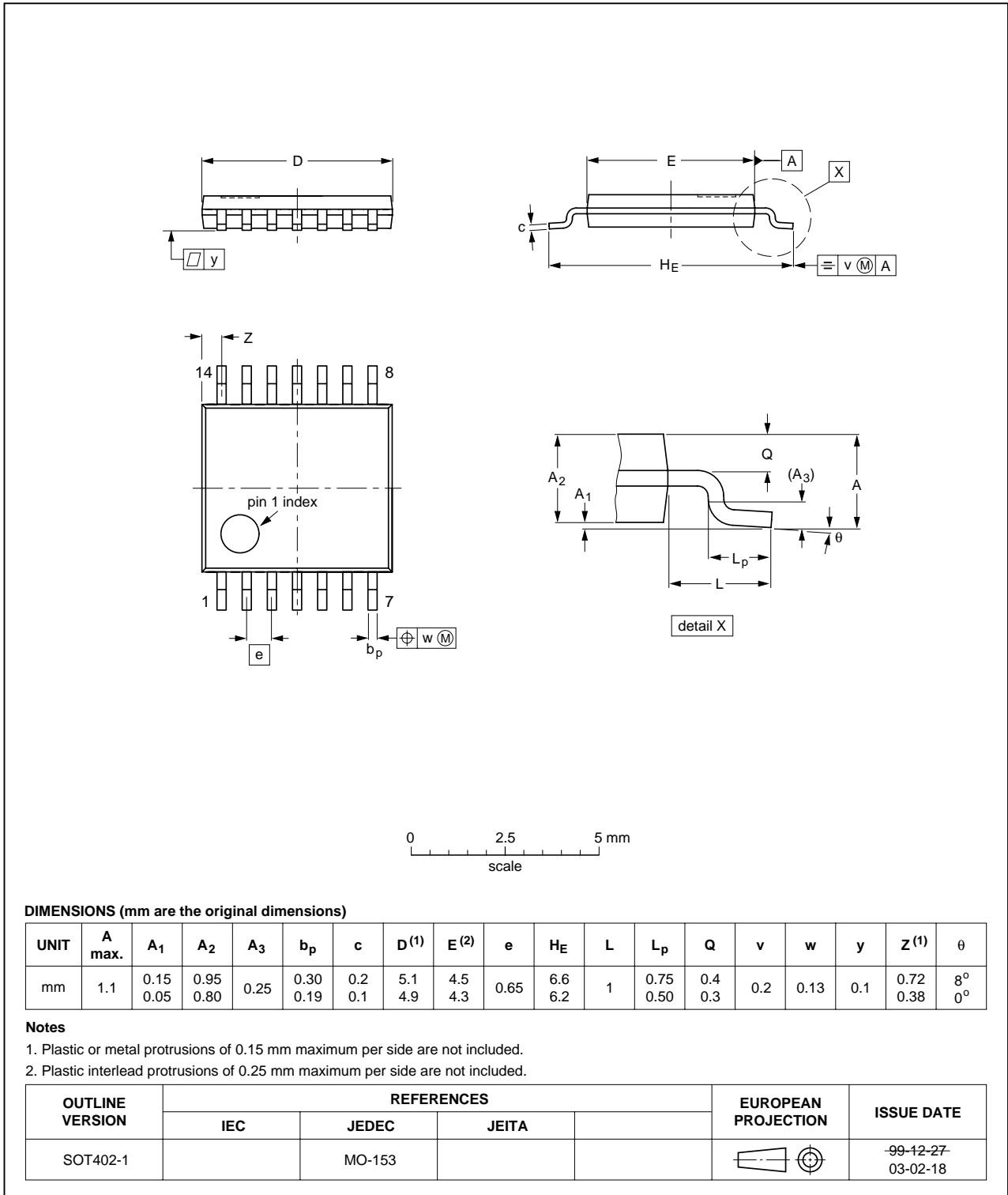


Fig 10. Package outline SOT402-1 (TSSOP14)

DHVQFN14: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 x 3 x 0.85 mm

SOT762-1

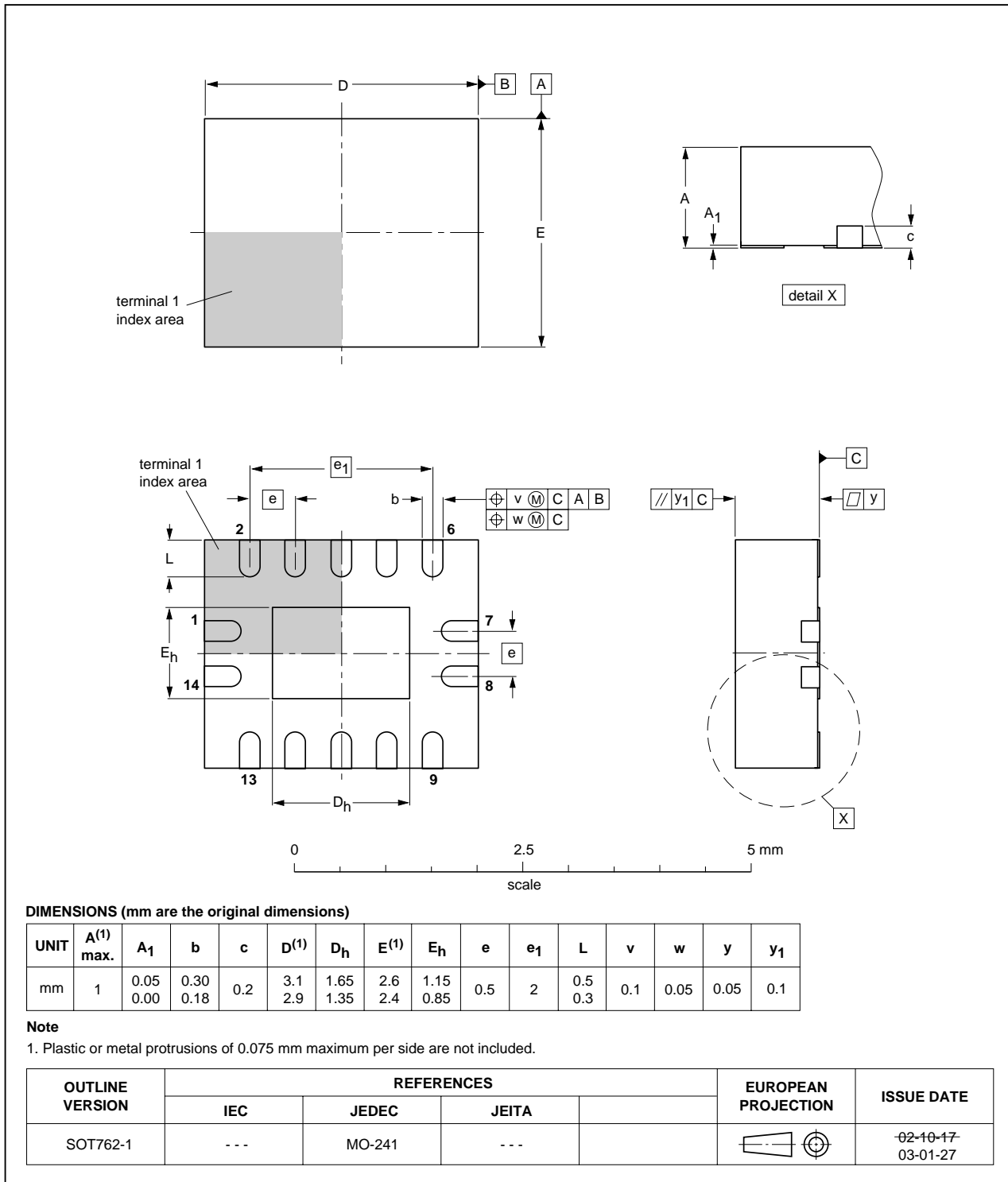


Fig 11. Package outline SOT762-1 (DHVQFN14)

13. Abbreviations

Table 10. Abbreviations

| Acronym | Description |
|---------|-----------------------------|
| CDM | Charged-Device Model |
| 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 |
|----------------|--|-----------------------|---------------|-------------|
| 74ALVC125_2 | 20080110 | Product data sheet | - | 74ALVC125_1 |
| Modifications: | <ul style="list-style-type: none"> • The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • Section 3: DHVQFN14 package added. • Section 7: derating values added for DHVQFN14 package. • Section 12: outline drawing added for DHVQFN14 package. | | | |
| 74ALVC125_1 | 20021118 | Product specification | - | - |

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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. |
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[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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