# 74ALVC125-Q100

## Quad buffer/line driver; 3-state

Rev. 1 — 28 June 2013 Product data sheet

## 1. General description

The 74ALVC125-Q100 is a quad non-inverting buffer/line driver with 3-state outputs. The output enable input ($n\overline{OE}$) controls the 3 state outputs (nY). A HIGH on the $n\overline{OE}$ pin causes the outputs to assume a high-impedance OFF-state.

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 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:
  - MIL-STD-833, 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 |
| 74ALVC125D-Q100 | –40 °C to +85 °C | SO14 | plastic small outline package; 14 leads; body width 3.9 mm | SOT108-1 |
| 74ALVC125PW-Q100 | –40 °C to +85 °C | TSSOP14 | plastic thin shrink small outline package; 14 leads; body width 4.4 mm | SOT402-1 |
| 74ALVC125BQ-Q100 | –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 x 3 x 0.85 mm | SOT762-1 |

## 4. Functional diagram

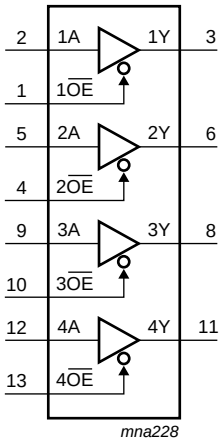



**Fig 1. Logic symbol**

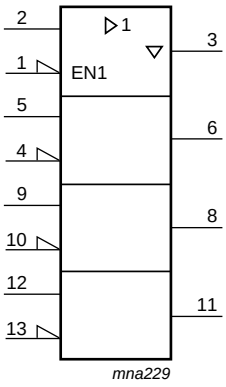



**Fig 2. IEC logic symbol**

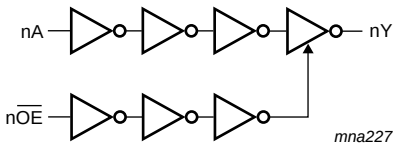



**Fig 3. Logic diagram (one buffer)**

# 5. Pinning information

## 5.1 Pinning

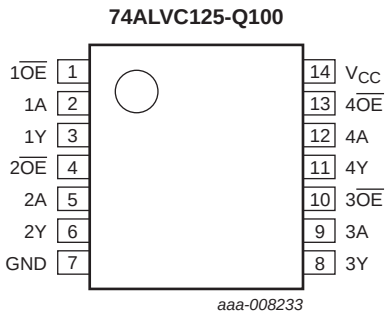
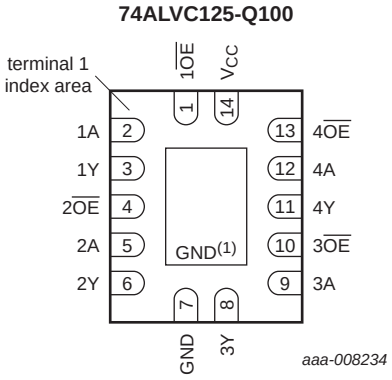



Fig 4. Pin configuration SO14 and TSSOP14




Transparent top view

(1) The die substrate is attached to this pad using conductive die attach material. It cannot 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 |
| $n\overline{OE}$ | 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 |
|---|---|---|
| $n\overline{OE}$ | 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 × $V_{CC}$ | - | - | 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 × $V_{CC}$ | 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 μA; $V_{CC}$ = 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 μA; $V_{CC}$ = 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 | μA |

**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 | µA |
| $I_{OFF}$ | power-off leakage current | $V_{CC}$ = 0 V; $V_I$ or $V_O$ = 0 V to 3.6 V | - | ±0.1 | ±10 | µA |
| $I_{CC}$ | supply current | $V_{CC}$ = 3.6 V; $V_I = V_{CC}$ or GND; $I_O$ = 0 A | - | 0.2 | 10 | µA |
| $\Delta I_{CC}$ | 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 | µA |
| $C_I$ | 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 characteristics**

*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 | |
| $t_{pd}$ | 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 |
| | | $V_{CC}$ = 3.0 V to 3.6 V | | 1.1 | 1.8 | 2.8 | ns |
| $t_{en}$ | enable time | $n\overline{OE}$ 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 |
| | | $V_{CC}$ = 2.7 V | | - | 2.7 | 4.3 | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V | | 1.0 | 1.9 | 3.5 | ns |
| $t_{dis}$ | disable time | $n\overline{OE}$ 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.*

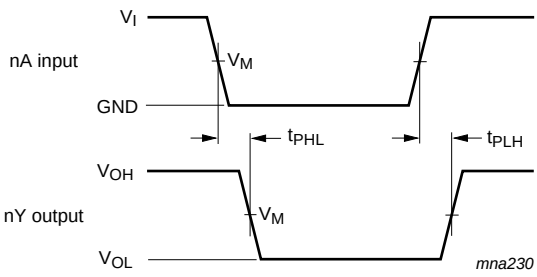
| Symbol | Parameter | Conditions | –40 °C to +85 °C | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ[1] | Max | |
| $C_{PD}$ | power dissipation capacitance | per buffer; $V_I$ = GND to $V_{CC}$; $V_{CC}$ = 3.3 V [3] | | | | |
| | | outputs HIGH or LOW state | - | 27 | - | pF |
| | | outputs 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
$\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs

## 11. Waveforms



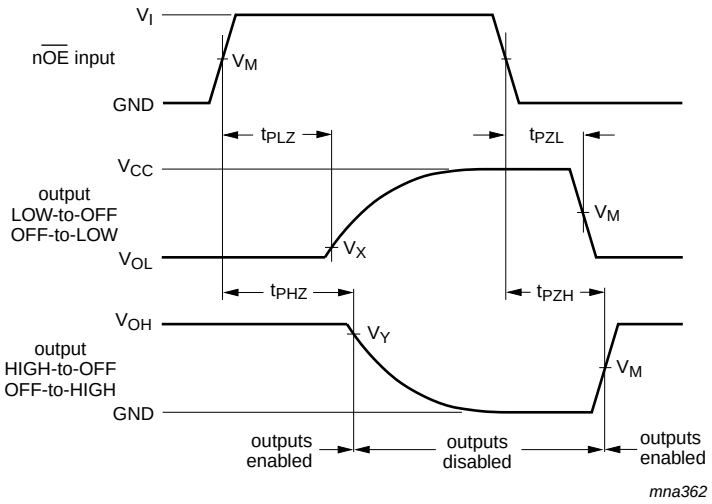

Measurement points are given in Table 8.

$V_{OL}$ 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**

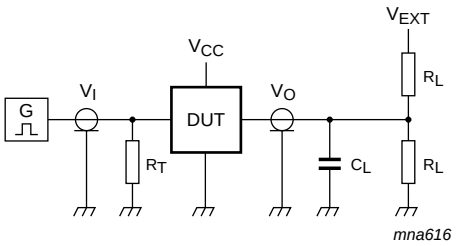
| Supply voltage | Input | Output | | |
|---|---|---|---|---|
| $V_{CC}$ | $V_M$ | $V_M$ | $V_x$ | $V_y$ |
| 1.65 V to 1.95 V | $0.5V_{CC}$ | $0.5V_{CC}$ | $V_{OL}$ + 0.15 V | $V_{OH}$ – 0.15 V |
| 2.3 V to 2.7 V | $0.5V_{CC}$ | $0.5V_{CC}$ | $V_{OL}$ + 0.15 V | $V_{OH}$ – 0.15 V |
| 2.7 V | 1.5 V | 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.

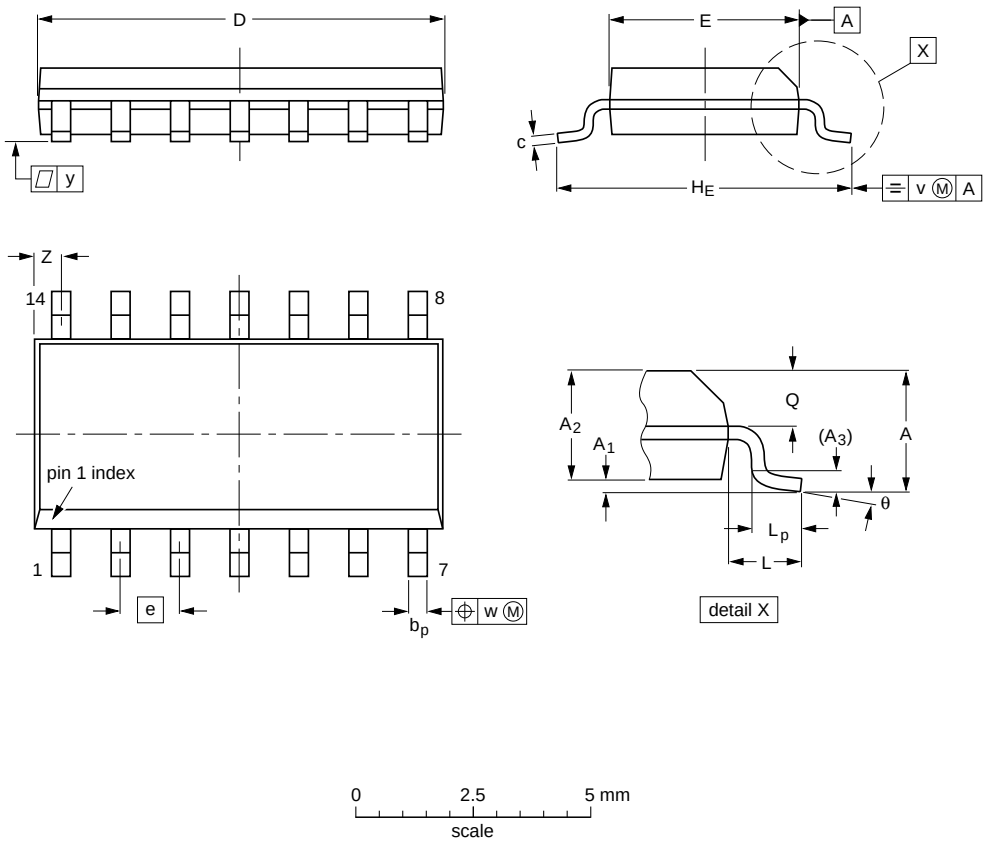
**Fig 8. Test circuitry for switching times**

**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 kΩ | open | 2 × $V_{CC}$ | GND |
| 2.3 V to 2.7 V | $V_{CC}$ | ≤ 2.0 ns | 30 pF | 500 Ω | open | 2 × $V_{CC}$ | 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**




**DIMENSIONS (inch dimensions are derived from the original mm dimensions)**

| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | $D^{(1)}$ | $E^{(1)}$ | e | $H_E$ | L | $L_p$ | Q | v | w | y | $Z^{(1)}$ | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.75 | 0.25<br>0.10 | 1.45<br>1.25 | 0.25 | 0.49<br>0.36 | 0.25<br>0.19 | 8.75<br>8.55 | 4.0<br>3.8 | 1.27 | 6.2<br>5.8 | 1.05 | 1.0<br>0.4 | 0.7<br>0.6 | 0.25 | 0.25 | 0.1 | 0.7<br>0.3 | $8^o$<br>$0^o$ |
| inches | 0.069 | 0.010<br>0.004 | 0.057<br>0.049 | 0.01 | 0.019<br>0.014 | 0.0100<br>0.0075 | 0.35<br>0.34 | 0.16<br>0.15 | 0.05 | 0.244<br>0.228 | 0.041 | 0.039<br>0.016 | 0.028<br>0.024 | 0.01 | 0.01 | 0.004 | 0.028<br>0.012 | |

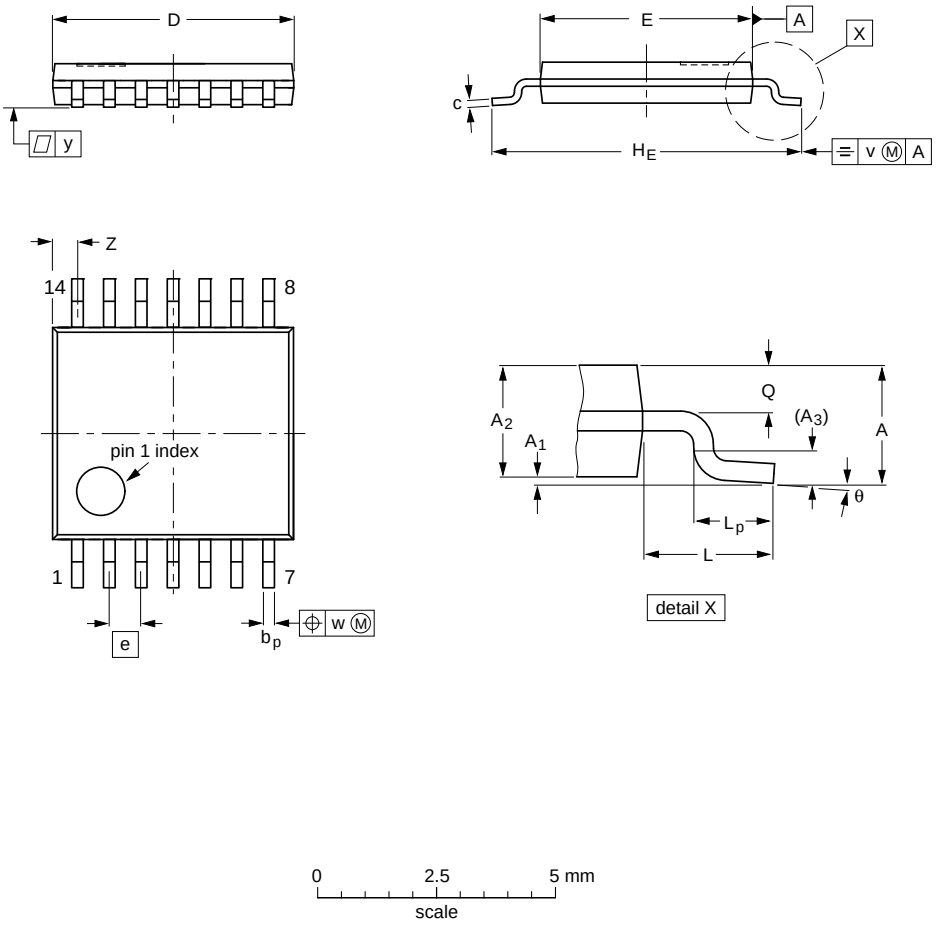
**Note**

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT108-1 | 076E06 | MS-012 | | | | ~~99-12-27~~<br>03-02-19 |

**Fig 9. Package outline SOT108-1 (SO14)**

**TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm** **SOT402-1**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | D (1) | E (2) | e | $H_E$ | L | $L_p$ | Q | v | w | y | Z (1) | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.1 | 0.15<br>0.05 | 0.95<br>0.80 | 0.25 | 0.30<br>0.19 | 0.2<br>0.1 | 5.1<br>4.9 | 4.5<br>4.3 | 0.65 | 6.6<br>6.2 | 1 | 0.75<br>0.50 | 0.4<br>0.3 | 0.2 | 0.13 | 0.1 | 0.72<br>0.38 | $8^o$<br>$0^o$ |

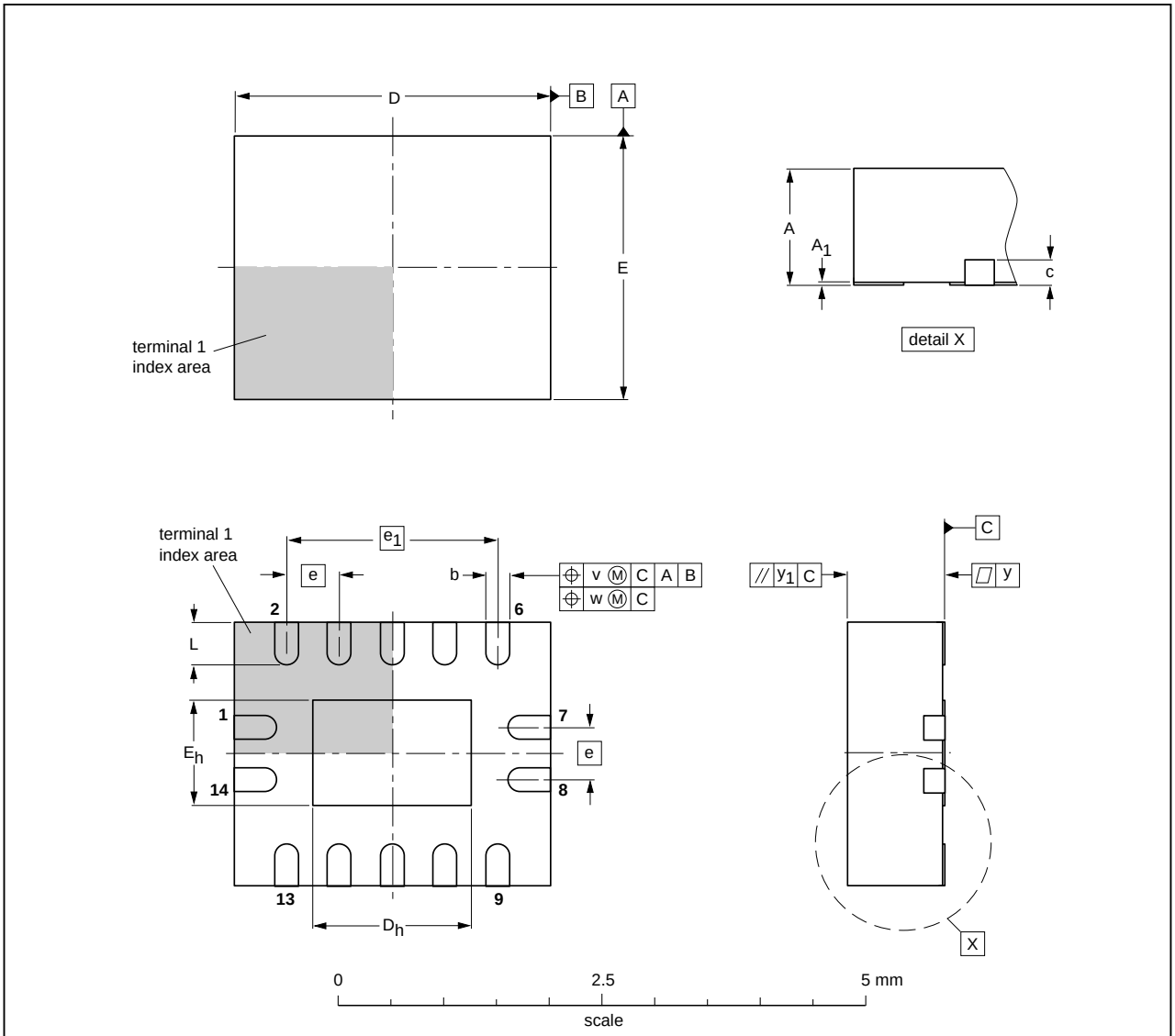
**Notes**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT402-1 | | MO-153 | | | | ~~99-12-27~~<br>03-02-18 |

**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**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | A(1) max. | $A_1$ | b | c | D(1) | $D_h$ | E(1) | $E_h$ | e | $e_1$ | L | v | w | y | $y_1$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1 | 0.05<br>0.00 | 0.30<br>0.18 | 0.2 | 3.1<br>2.9 | 1.65<br>1.35 | 2.6<br>2.4 | 1.15<br>0.85 | 0.5 | 2 | 0.5<br>0.3 | 0.1 | 0.05 | 0.05 | 0.1 |

**Note**

1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT762-1 | - - - | MO-241 | - - - | | | ~~02-10-17~~<br>03-01-27 |

**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 |
| MIL | Military |
| 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_Q100 v.1 | 20130628 | 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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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For sales office addresses, please send an email to: **salesaddresses@nxp.com**

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