

# 74LVC02A

## Quad 2-input NOR gate

Rev. 8 — 16 November 2011

Product data sheet

## 1. General description

The 74LVC02A provides four 2-input NOR gates.

Inputs can be driven from either 3.3 V or 5 V devices. This feature allows the use of these devices as translators in mixed 3.3 V and 5 V applications.

## 2. Features and benefits

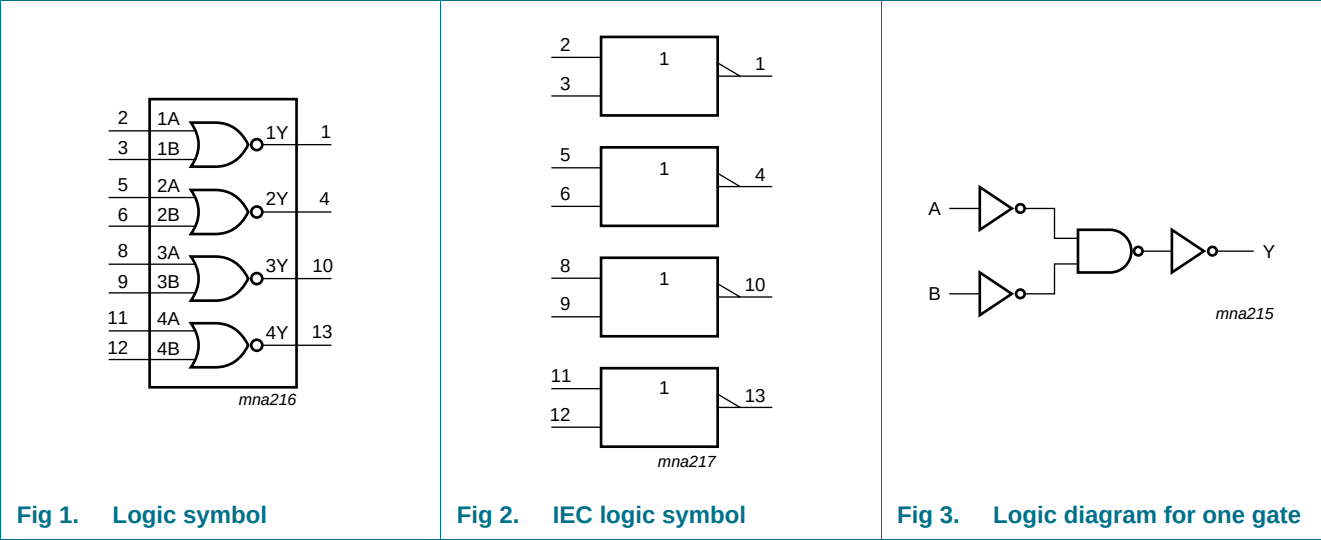
- 5 V tolerant inputs for interfacing with 5 V logic
- Wide supply voltage range from 1.2 V to 3.6 V
- CMOS low power consumption
- Direct interface with TTL levels
- Complies with JEDEC standard:
  - ◆ JESD8-7A (1.65 V to 1.95 V)
  - ◆ JESD8-5A (2.3 V to 2.7 V)
  - ◆ JESD8-C/JESD36 (2.7 V to 3.6 V)
- ESD protection:
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ MM JESD22-A115-B exceeds 200 V
  - ◆ CDM JESD22-C101E exceeds 1000 V
- Specified from –40 °C to +85 °C and –40 °C to +125 °C

## 3. Ordering information

Table 1. Ordering information

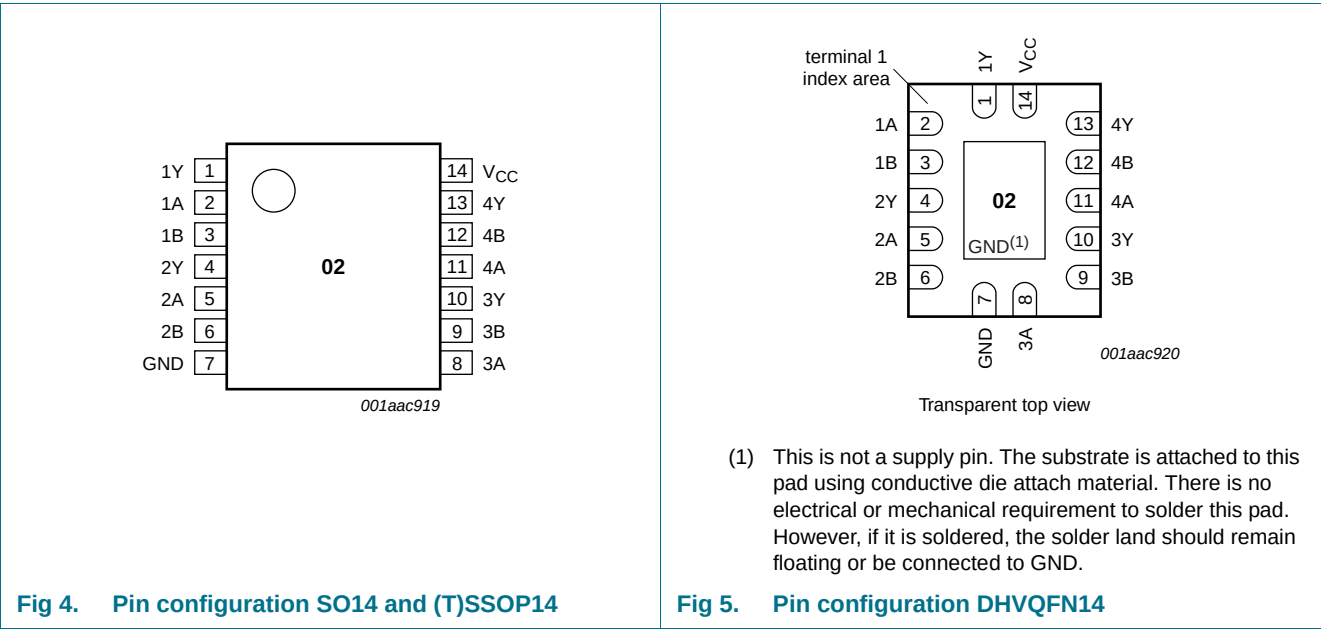
| Type number | Package           |          |                                                                                                                                    |          |
|-------------|-------------------|----------|------------------------------------------------------------------------------------------------------------------------------------|----------|
|             | Temperature range | Name     | Description                                                                                                                        | Version  |
| 74LVC02AD   | –40 °C to +125 °C | SO14     | plastic small outline package; 14 leads;<br>body width 3.9 mm                                                                      | SOT108-1 |
| 74LVC02ADB  | –40 °C to +125 °C | SSOP14   | plastic shrink small outline package; 14 leads;<br>body width 5.3 mm                                                               | SOT337-1 |
| 74LVC02APW  | –40 °C to +125 °C | TSSOP14  | plastic thin shrink small outline package; 14 leads;<br>body width 4.4 mm                                                          | SOT402-1 |
| 74LVC02ABQ  | –40 °C to +125 °C | DHVQFN14 | plastic dual in-line compatible thermal enhanced very<br>thin quad flat package; no leads; 14 terminals;<br>body 2.5 × 3 × 0.85 mm | SOT762-1 |

4. Functional diagram



5. Pinning information

5.1 Pinning



## 5.2 Pin description

**Table 2.** Pin description

| Symbol          | Pin          | Description    |
|-----------------|--------------|----------------|
| 1Y to 4Y        | 1, 4, 10, 13 | data output    |
| 1A to 4A        | 2, 5, 8, 11  | data input     |
| 1B to 4B        | 3, 6, 9, 12  | data input     |
| GND             | 7            | ground (0 V)   |
| V <sub>CC</sub> | 14           | supply voltage |

## 6. Functional description

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

| Input nA | Input nB | Output nY |
|----------|----------|-----------|
| L        | L        | H         |
| X        | H        | L         |
| H        | X        | L         |

[1] H = HIGH voltage level; L = LOW voltage level; X = don't care

## 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                | +6.5                  | V    |
| I <sub>IK</sub>  | input clamping current  | V <sub>I</sub> < 0 V                                     | -50                 | -                     | mA   |
| V <sub>I</sub>   | input voltage           |                                                          | <sup>[1]</sup> -0.5 | +6.5                  | V    |
| I <sub>OK</sub>  | output clamping current | V <sub>O</sub> > V <sub>CC</sub> or V <sub>O</sub> < 0 V | -                   | ±50                   | mA   |
| V <sub>O</sub>   | output voltage          | output in HIGH or LOW-state                              | <sup>[2]</sup> -0.5 | V <sub>CC</sub> + 0.5 | V    |
| I <sub>O</sub>   | output current          | V <sub>O</sub> = 0 V to V <sub>CC</sub>                  | -                   | ±50                   | mA   |
| I <sub>CC</sub>  | supply current          |                                                          | -                   | 100                   | mA   |
| I <sub>GND</sub> | ground current          |                                                          | -100                | -                     | mA   |
| P <sub>tot</sub> | total power dissipation | T <sub>amb</sub> = -40 °C to +125 °C                     | <sup>[3]</sup> -    | 500                   | mW   |
| T <sub>stg</sub> | storage temperature     |                                                          | -65                 | +150                  | °C   |

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

[2] The output voltage ratings may be exceeded if the output current ratings are observed.

[3] For SO14 packages: above 70 °C derate linearly with 8 mW/K.  
 For (T)SSOP14 packages: above 60 °C derate linearly with 5.5 mW/K.  
 For DHVQFN14 packages: above 60 °C derate linearly with 4.5 mW/K.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

| Symbol              | Parameter                           | Conditions                                  | Min  | Typ | Max      | Unit |
|---------------------|-------------------------------------|---------------------------------------------|------|-----|----------|------|
| $V_{CC}$            | supply voltage                      |                                             | 1.65 | -   | 3.6      | V    |
|                     |                                     | functional                                  | 1.2  | -   | -        | V    |
| $V_I$               | input voltage                       |                                             | 0    | -   | 5.5      | V    |
| $V_O$               | output voltage                      | output HIGH or LOW state                    | 0    | -   | $V_{CC}$ | V    |
| $T_{amb}$           | ambient temperature                 |                                             | -40  | -   | +125     | °C   |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 1.65 \text{ V to } 2.7 \text{ V}$ | 0    | -   | 20       | ns/V |
|                     |                                     | $V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$  | 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     |                    |                      | -40 °C to +125 °C    |                      | Unit          |
|----------|---------------------------|---------------------------------------------------------------------|----------------------|--------------------|----------------------|----------------------|----------------------|---------------|
|          |                           |                                                                     | Min                  | Typ <sup>[1]</sup> | Max                  | Min                  | Max                  |               |
| $V_{IH}$ | HIGH-level input voltage  | $V_{CC} = 1.2 \text{ V}$                                            | 1.08                 | -                  | -                    | 1.08                 | -                    | V             |
|          |                           | $V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$                        | $0.65 \times V_{CC}$ | -                  | -                    | $0.65 \times V_{CC}$ | -                    | V             |
|          |                           | $V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$                          | 1.7                  | -                  | -                    | 1.7                  | -                    | V             |
|          |                           | $V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$                          | 2.0                  | -                  | -                    | 2.0                  | -                    | V             |
| $V_{IL}$ | LOW-level input voltage   | $V_{CC} = 1.2 \text{ V}$                                            | -                    | -                  | 0.12                 | -                    | 0.12                 | V             |
|          |                           | $V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$                        | -                    | -                  | $0.35 \times V_{CC}$ | -                    | $0.35 \times V_{CC}$ | V             |
|          |                           | $V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$                          | -                    | -                  | 0.7                  | -                    | 0.7                  | V             |
|          |                           | $V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$                          | -                    | -                  | 0.8                  | -                    | 0.8                  | V             |
| $V_{OH}$ | HIGH-level output voltage | $V_I = V_{IH} \text{ or } V_{IL}$                                   |                      |                    |                      |                      |                      |               |
|          |                           | $I_O = -100 \mu\text{A}; V_{CC} = 1.65 \text{ V to } 3.6 \text{ V}$ | $V_{CC} - 0.2$       | -                  | -                    | $V_{CC} - 0.3$       | -                    | V             |
|          |                           | $I_O = -4 \text{ mA}; V_{CC} = 1.65 \text{ V}$                      | 1.2                  | -                  | -                    | 1.05                 | -                    | V             |
|          |                           | $I_O = -8 \text{ mA}; V_{CC} = 2.3 \text{ V}$                       | 1.8                  | -                  | -                    | 1.65                 | -                    | V             |
|          |                           | $I_O = -12 \text{ mA}; V_{CC} = 2.7 \text{ V}$                      | 2.2                  | -                  | -                    | 2.05                 | -                    | V             |
|          |                           | $I_O = -18 \text{ mA}; V_{CC} = 3.0 \text{ V}$                      | 2.4                  | -                  | -                    | 2.25                 | -                    | V             |
| $V_{OL}$ | LOW-level output voltage  | $I_O = -24 \text{ mA}; V_{CC} = 3.0 \text{ V}$                      | 2.2                  | -                  | -                    | 2.0                  | -                    | V             |
|          |                           | $V_I = V_{IH} \text{ or } V_{IL}$                                   |                      |                    |                      |                      |                      |               |
|          |                           | $I_O = 100 \mu\text{A}; V_{CC} = 1.65 \text{ V to } 3.6 \text{ V}$  | -                    | -                  | 0.2                  | -                    | 0.3                  | V             |
|          |                           | $I_O = 4 \text{ mA}; V_{CC} = 1.65 \text{ V}$                       | -                    | -                  | 0.45                 | -                    | 0.65                 | V             |
|          |                           | $I_O = 8 \text{ mA}; V_{CC} = 2.3 \text{ V}$                        | -                    | -                  | 0.6                  | -                    | 0.8                  | V             |
|          |                           | $I_O = 12 \text{ mA}; V_{CC} = 2.7 \text{ V}$                       | -                    | -                  | 0.4                  | -                    | 0.6                  | V             |
| $I_I$    | input leakage current     | $I_O = 24 \text{ mA}; V_{CC} = 3.0 \text{ V}$                       | -                    | -                  | 0.55                 | -                    | 0.8                  | V             |
|          |                           | $V_{CC} = 3.6 \text{ V}; V_I = 5.5 \text{ V or GND}$                | -                    | $\pm 0.1$          | $\pm 5$              | -                    | $\pm 20$             | $\mu\text{A}$ |

**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 |                    |     | –40 °C to +125 °C |      | Unit |
|------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------|------------------|--------------------|-----|-------------------|------|------|
|                  |                           |                                                                                                                 | Min              | Typ <sup>[1]</sup> | Max | Min               | Max  |      |
| I <sub>CC</sub>  | supply current            | V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A                          | -                | 0.1                | 10  | -                 | 40   | μA   |
| ΔI <sub>CC</sub> | additional supply current | per input pin; V <sub>CC</sub> = 2.7 V to 3.6 V; V <sub>I</sub> = V <sub>CC</sub> – 0.6 V; I <sub>O</sub> = 0 A | -                | 5                  | 500 | -                 | 5000 | μA   |
| C <sub>I</sub>   | input capacitance         | V <sub>CC</sub> = 0 V to 3.6 V; V <sub>I</sub> = GND to V <sub>CC</sub>                                         | -                | 4.0                | -   | -                 | -    | pF   |

[1] All typical values are measured at V<sub>CC</sub> = 3.3 V (unless stated otherwise) and T<sub>amb</sub> = 25 °C.

## 10. Dynamic characteristics

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

| 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, nB to nY; see <a href="#">Figure 6</a> <sup>[2]</sup>        |                  |                    |     |                   |      |      |
|                    |                               | V <sub>CC</sub> = 1.2 V                                          | -                | 14                 | -   | -                 | -    | ns   |
|                    |                               | V <sub>CC</sub> = 1.65 V to 1.95 V                               | 0.5              | 4.0                | 8.6 | 0.5               | 10.1 | ns   |
|                    |                               | V <sub>CC</sub> = 2.3 V to 2.7 V                                 | 1.0              | 2.4                | 4.9 | 1.0               | 5.7  | ns   |
|                    |                               | V <sub>CC</sub> = 2.7 V                                          | 1.0              | 2.5                | 5.1 | 1.0               | 6.5  | ns   |
|                    |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                 | 1.0              | 2.2                | 4.4 | 1.0               | 5.5  | ns   |
| t <sub>sk(o)</sub> | output skew time              | V <sub>CC</sub> = 3.0 V to 3.6 V <sup>[3]</sup>                  | -                | -                  | 1.0 | -                 | 1.5  | ns   |
| C <sub>PD</sub>    | power dissipation capacitance | per gate; V <sub>I</sub> = GND to V <sub>CC</sub> <sup>[4]</sup> |                  |                    |     |                   |      |      |
|                    |                               | V <sub>CC</sub> = 1.65 V to 1.95 V                               | -                | 2.5                | -   | -                 | -    | pF   |
|                    |                               | V <sub>CC</sub> = 2.3 V to 2.7 V                                 | -                | 5.7                | -   | -                 | -    | pF   |
|                    |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                 | -                | 8.5                | -   | -                 | -    | pF   |

[1] Typical values are measured at T<sub>amb</sub> = 25 °C and V<sub>CC</sub> = 1.2 V, 1.8 V, 2.5 V, 2.7 V, and 3.3 V respectively.[2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.

[3] Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.

[4] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).P<sub>D</sub> = C<sub>PD</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>i</sub> × N + Σ(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) where:f<sub>i</sub> = input frequency in MHz; f<sub>o</sub> = output frequency in MHzC<sub>L</sub> = output load capacitance in pFV<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. AC waveforms

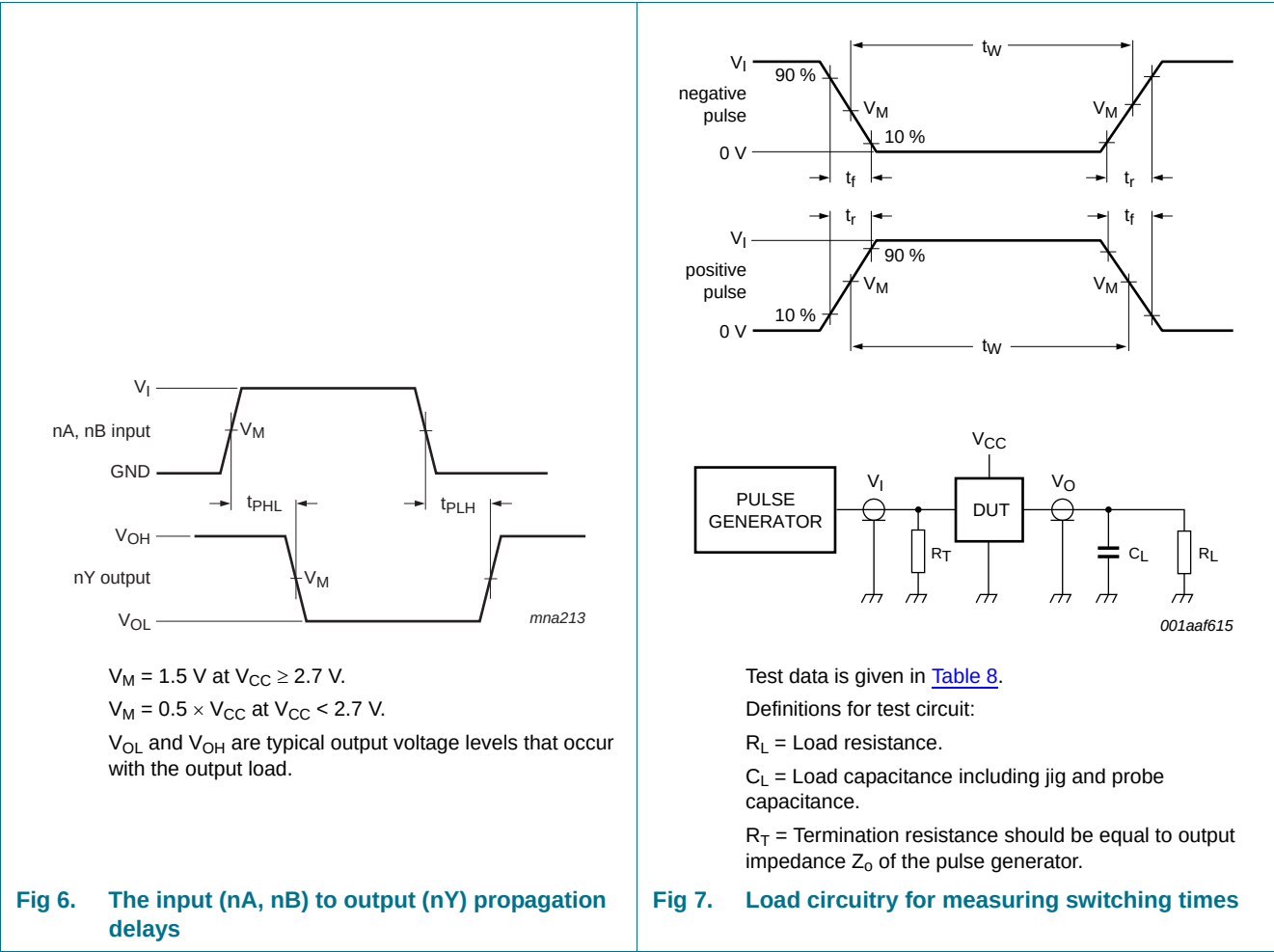


Table 8. Test data

| Supply voltage   | Input    |                      | Load  |              |
|------------------|----------|----------------------|-------|--------------|
|                  | $V_I$    | $t_r, t_f$           | $C_L$ | $R_L$        |
| 1.2 V            | $V_{CC}$ | $\leq 2\text{ ns}$   | 30 pF | 1 k $\Omega$ |
| 1.65 V to 1.95 V | $V_{CC}$ | $\leq 2\text{ ns}$   | 30 pF | 1 k $\Omega$ |
| 2.3 V to 2.7 V   | $V_{CC}$ | $\leq 2\text{ ns}$   | 30 pF | 500 $\Omega$ |
| 2.7 V            | 2.7 V    | $\leq 2.5\text{ ns}$ | 50 pF | 500 $\Omega$ |
| 3.0 V to 3.6 V   | 2.7 V    | $\leq 2.5\text{ ns}$ | 50 pF | 500 $\Omega$ |

12. Package outline

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

SOT108-1

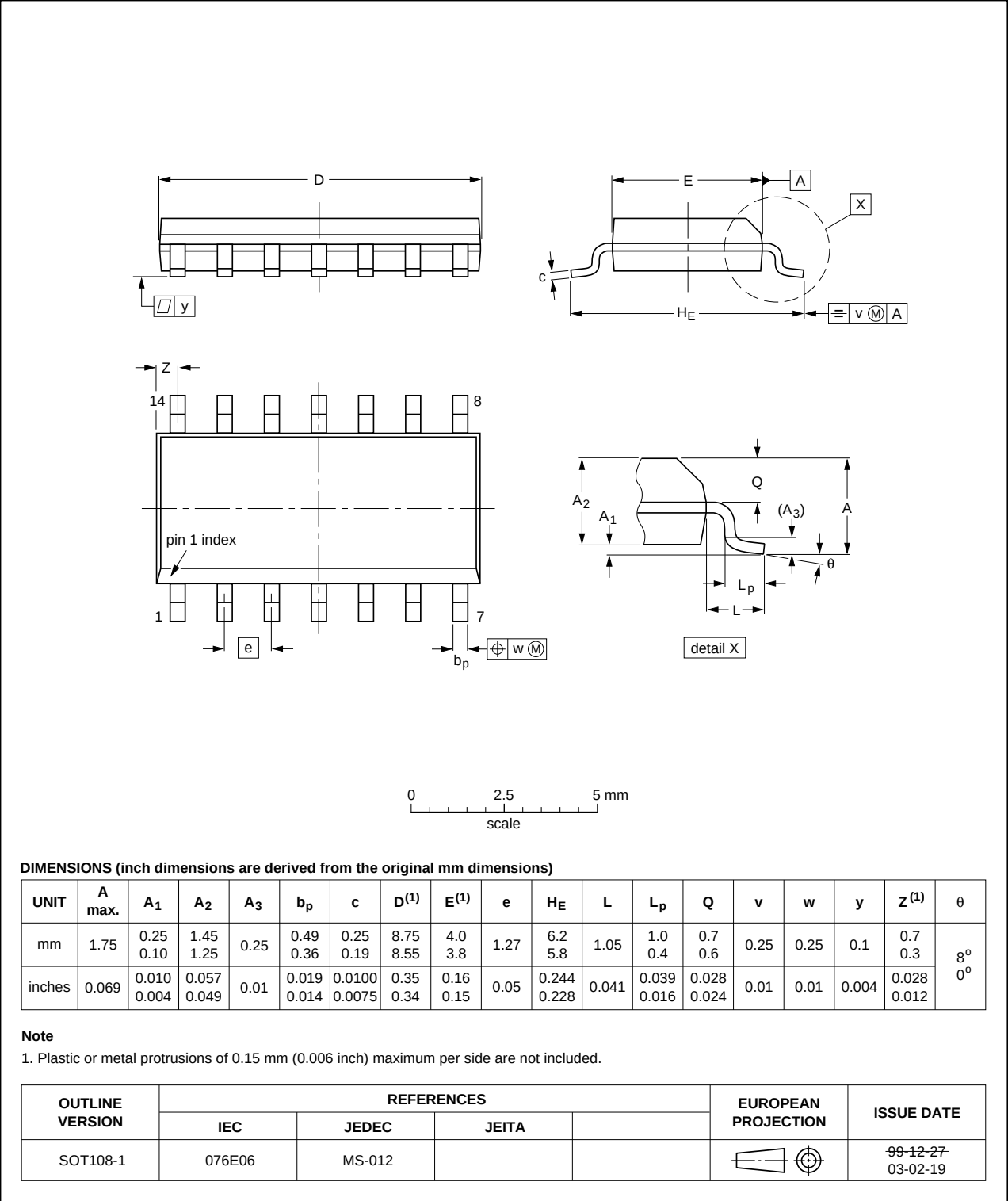


Fig 8. Package outline SOT108-1 (SO14)

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

SOT337-1

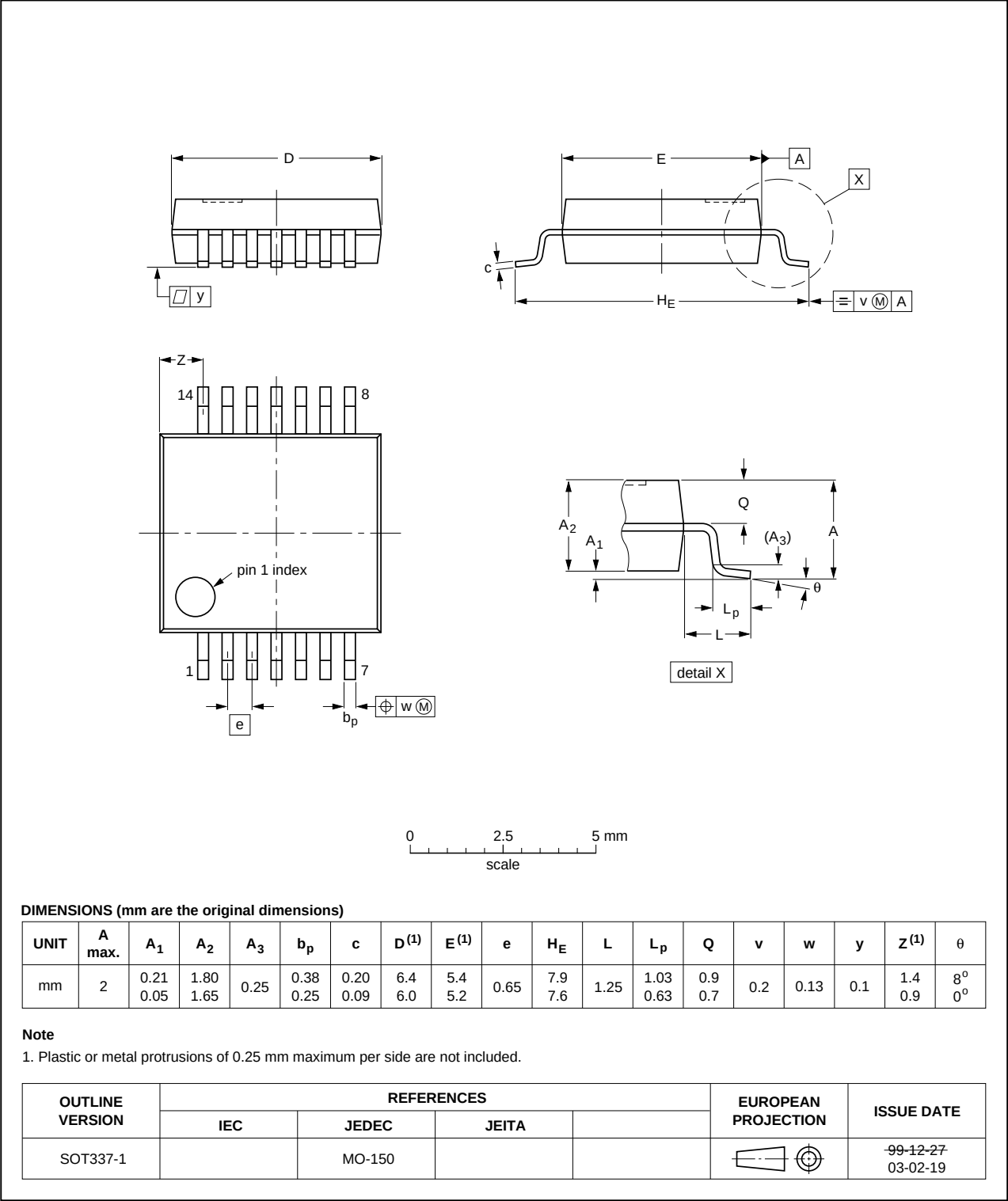


Fig 9. Package outline SOT337-1 (SSOP14)

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

SOT402-1

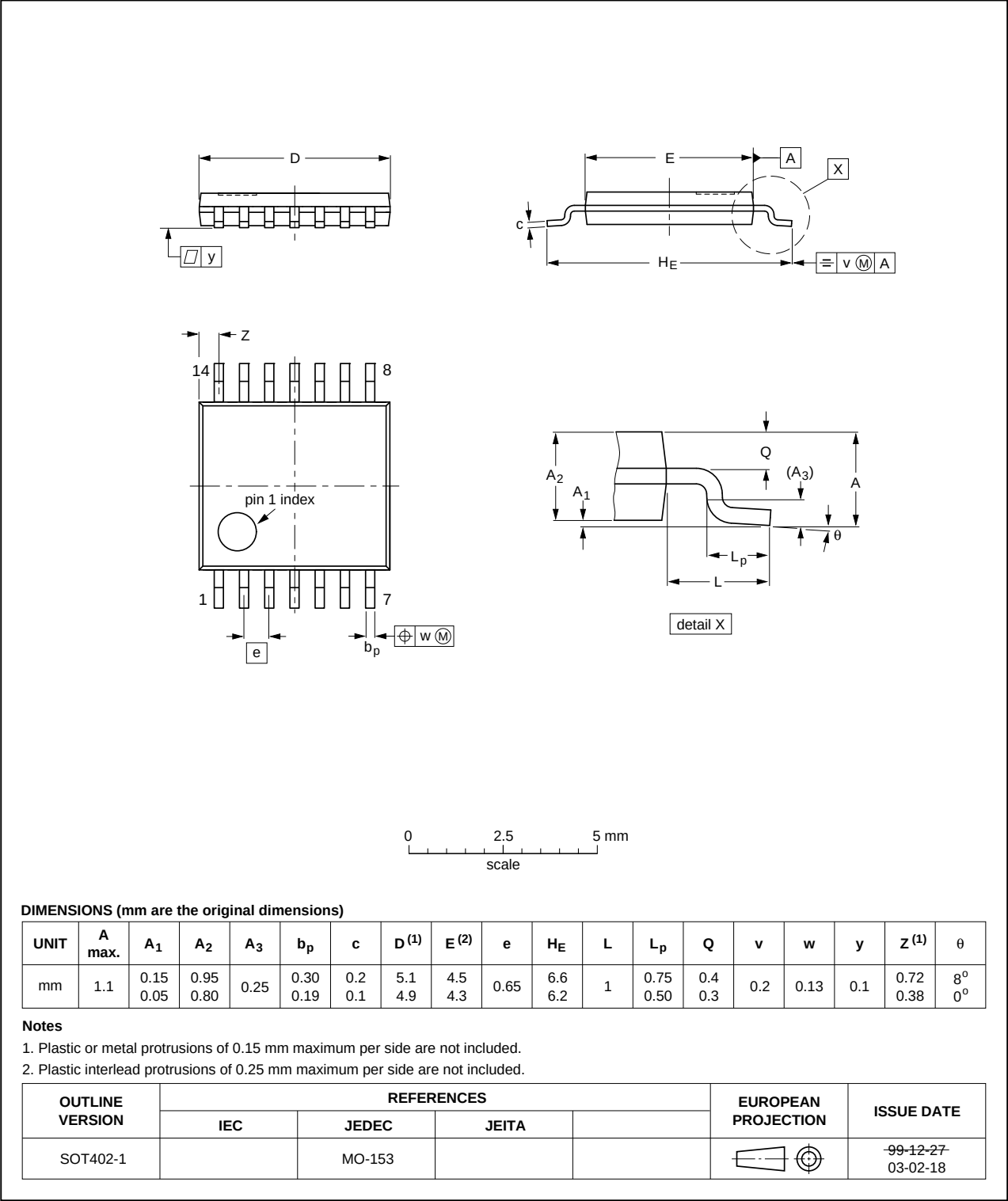


Fig 10. Package outline SOT402-1 (TSSOP14)

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

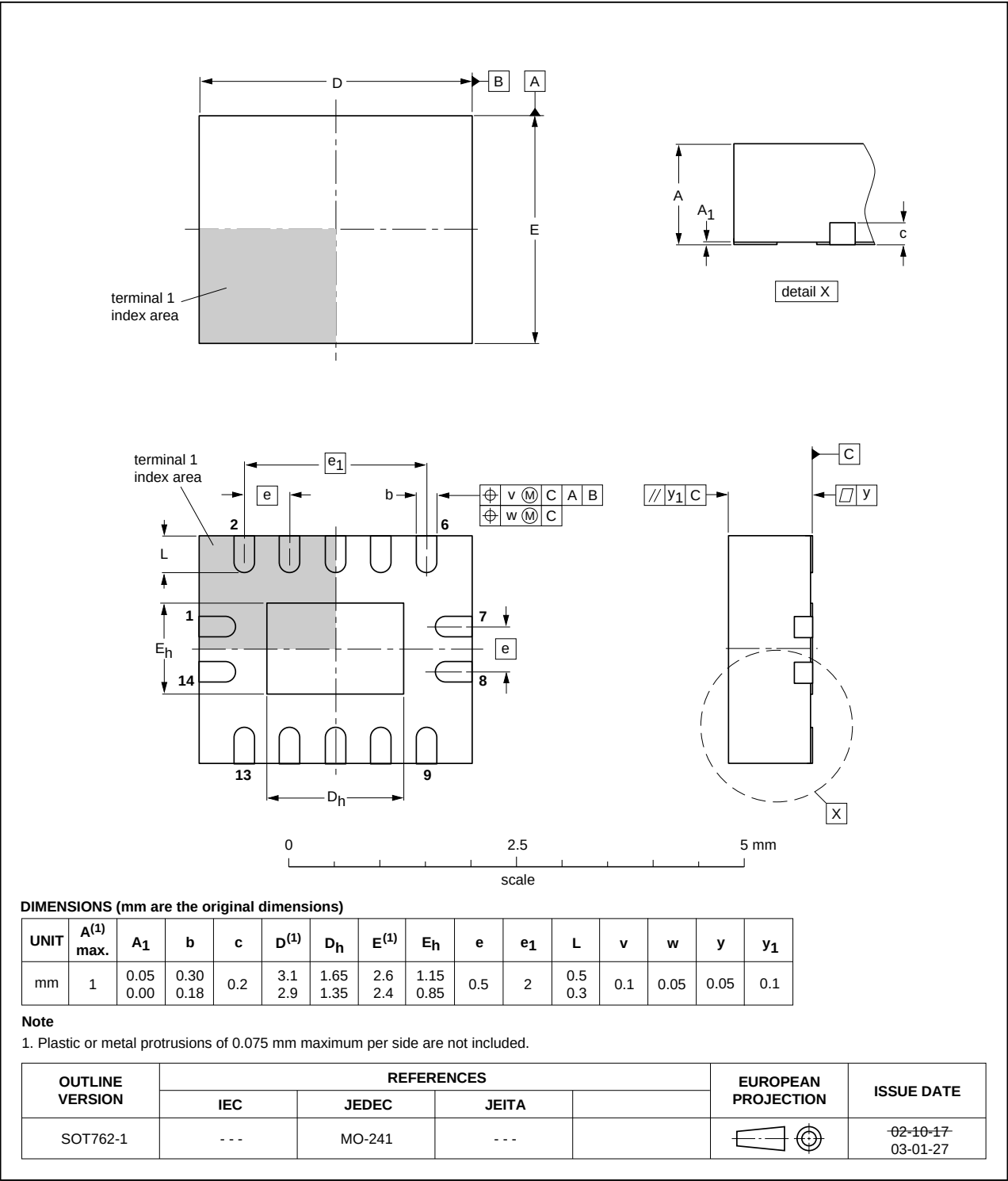


Fig 11. Package outline SOT762-1 (DHVQFN14)

## 13. Abbreviations

Table 9. 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 10. Revision history

| Document ID    | Release date                                                                                                                                                                     | Data sheet status     | Change notice | Supersedes   |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|--------------|
| 74LVC02A v.8   | 20111116                                                                                                                                                                         | Product data sheet    | -             | 74LVC02A v.7 |
| Modifications: | <ul style="list-style-type: none"><li>Legal pages updated.</li><li><a href="#">Table 6</a>, bodyrow <math>\Delta I_{CC}</math>: condition <math>V_{CC}</math> changed.</li></ul> |                       |               |              |
| 74LVC02A v.7   | 20111019                                                                                                                                                                         | Product data sheet    | -             | 74LVC02A v.6 |
| 74LVC02A v.6   | 20110809                                                                                                                                                                         | Product data sheet    | -             | 74LVC02A v.5 |
| 74LVC02A v.5   | 20040312                                                                                                                                                                         | Product specification | -             | 74LVC02A v.4 |
| 74LVC02A v.4   | 20030501                                                                                                                                                                         | Product specification | -             | 74LVC02A v.3 |
| 74LVC02A v.3   | 20020305                                                                                                                                                                         | Product specification | -             | 74LVC02A v.2 |
| 74LVC02A v.2   | 19980428                                                                                                                                                                         | Product specification | -             | 74LVC02A v.1 |
| 74LVC02A v.1   | 19970811                                                                                                                                                                         | 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".

[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.nexperia.com>.

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## 17. Contents

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## Данный компонент на территории Российской Федерации

**Вы можете приобрести в компании MosChip.**

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

<http://moschip.ru/get-element>

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

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