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Kind regards,

Team Nexperia

# 74HC32; 74HCT32

## Quad 2-input OR gate

Rev. 6 — 3 December 2015

Product data sheet

## 1. General description

The 74HC32; 74HCT32 is a quad 2-input OR gate. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ .

## 2. Features and benefits

- Complies with JEDEC standard JESD7A
- Input levels:
  - ◆ For 74HC32: CMOS level
  - ◆ For 74HCT32: TTL level
- Symmetrical output impedance
- High noise immunity
- Low power dissipation
- Balanced propagation delays
- ESD protection:
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  and from  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$

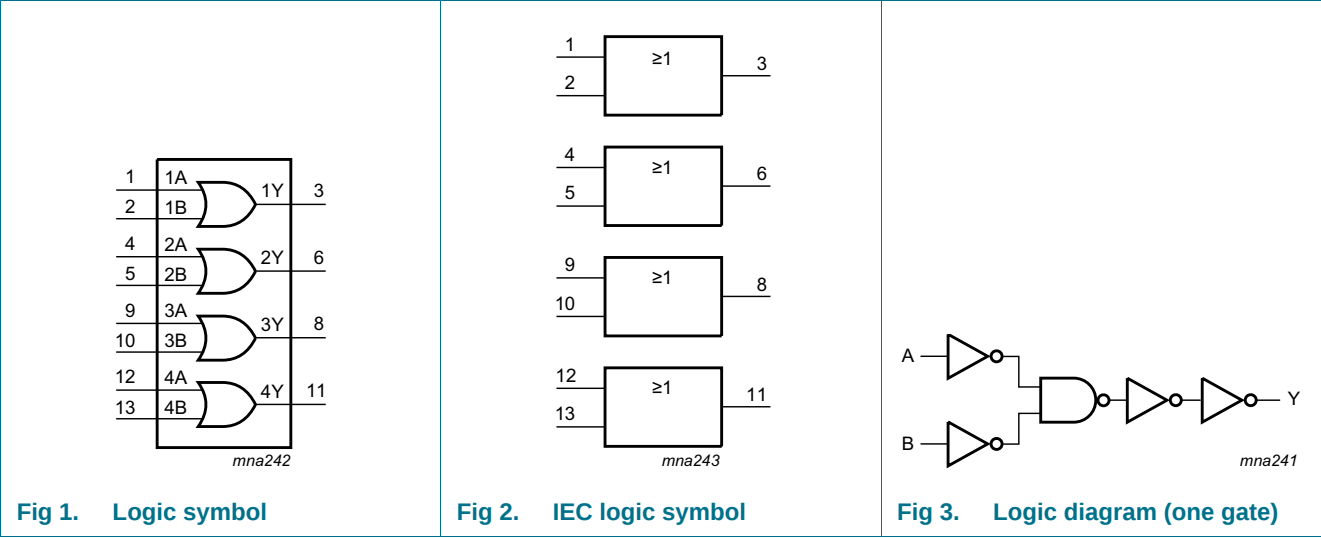
## 3. Ordering information

Table 1. Ordering information

| Type number | Package                                                         |          |                                                                                                                                                 |          |
|-------------|-----------------------------------------------------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------|----------|
|             | Temperature range                                               | Name     | Description                                                                                                                                     | Version  |
| 74HC32D     | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SO14     | plastic small outline package; 14 leads; body width 3.9 mm                                                                                      | SOT108-1 |
| 74HCT32D    |                                                                 |          |                                                                                                                                                 |          |
| 74HC32DB    | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SSOP14   | plastic shrink small outline package; 14 leads; body width 5.3 mm                                                                               | SOT337-1 |
| 74HCT32DB   |                                                                 |          |                                                                                                                                                 |          |
| 74HC32PW    | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | TSSOP14  | plastic thin shrink small outline package; 14 leads; body width 4.4 mm                                                                          | SOT402-1 |
| 74HCT32PW   |                                                                 |          |                                                                                                                                                 |          |
| 74HC32BQ    | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | DHVQFN14 | plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body $2.5 \times 3 \times 0.85\text{ mm}$ | SOT762-1 |
| 74HCT32BQ   |                                                                 |          |                                                                                                                                                 |          |

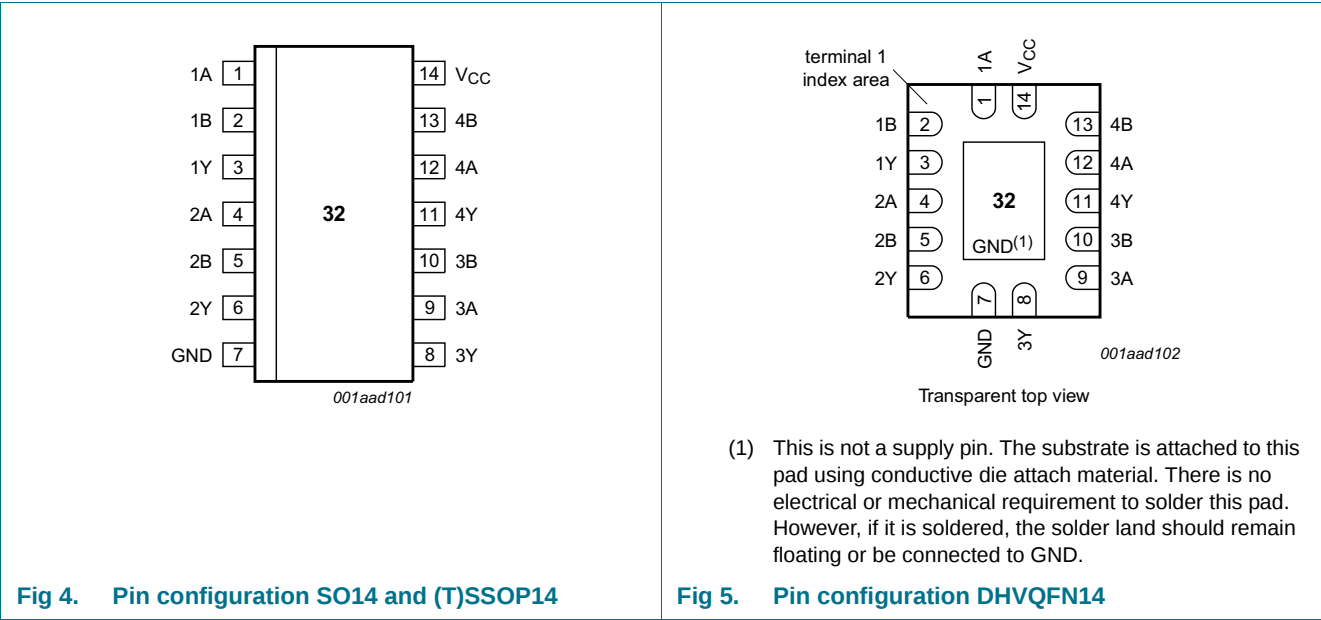


4. Functional diagram



5. Pinning information

5.1 Pinning



## 5.2 Pin description

Table 2. Pin description

| Symbol          | Pin          | Description    |
|-----------------|--------------|----------------|
| 1A to 4A        | 1, 4, 9, 12  | data input     |
| 1B to 4B        | 2, 5, 10, 13 | data input     |
| 1Y to 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>

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

- [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 | +7   | V    |
| I <sub>IK</sub>  | input clamping current  | V <sub>I</sub> < -0.5 V or V <sub>I</sub> > V <sub>CC</sub> + 0.5 V <sup>[1]</sup> | -    | ±20  | mA   |
| I <sub>OK</sub>  | output clamping current | V <sub>O</sub> < -0.5 V or V <sub>O</sub> > V <sub>CC</sub> + 0.5 V <sup>[1]</sup> | -    | ±20  | mA   |
| I <sub>O</sub>   | output current          | -0.5 V < V <sub>O</sub> < V <sub>CC</sub> + 0.5 V                                  | -    | ±25  | mA   |
| I <sub>CC</sub>  | supply current          |                                                                                    | -    | 50   | mA   |
| I <sub>GND</sub> | ground current          |                                                                                    | -50  | -    | mA   |
| T <sub>stg</sub> | storage temperature     |                                                                                    | -65  | +150 | °C   |
| P <sub>tot</sub> | total power dissipation | SO14, (T)SSOP14 and DHVQFN14 packages <sup>[2]</sup>                               | -    | 500  | mW   |

- [1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.  
[2] For SO14 package: P<sub>tot</sub> derates linearly with 8 mW/K above 70 °C.  
For (T)SSOP14 packages: P<sub>tot</sub> derates linearly with 5.5 mW/K above 60 °C.  
For DHVQFN14 packages: P<sub>tot</sub> derates linearly with 4.5 mW/K above 60 °C.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Voltages are referenced to GND (ground = 0 V)

| Symbol           | Parameter                           | Conditions              | 74HC32 |      |                 | 74HCT32 |      |                 | Unit |
|------------------|-------------------------------------|-------------------------|--------|------|-----------------|---------|------|-----------------|------|
|                  |                                     |                         | Min    | Typ  | Max             | Min     | Typ  | Max             |      |
| V <sub>CC</sub>  | supply voltage                      |                         | 2.0    | 5.0  | 6.0             | 4.5     | 5.0  | 5.5             | V    |
| V <sub>I</sub>   | input voltage                       |                         | 0      | -    | V <sub>CC</sub> | 0       | -    | V <sub>CC</sub> | V    |
| V <sub>O</sub>   | output voltage                      |                         | 0      | -    | V <sub>CC</sub> | 0       | -    | V <sub>CC</sub> | V    |
| T <sub>amb</sub> | ambient temperature                 |                         | -40    | -    | +125            | -40     | -    | +125            | °C   |
| Δt/ΔV            | input transition rise and fall rate | V <sub>CC</sub> = 2.0 V | -      | -    | 625             | -       | -    | -               | ns/V |
|                  |                                     | V <sub>CC</sub> = 4.5 V | -      | 1.67 | 139             | -       | 1.67 | 139             | ns/V |
|                  |                                     | V <sub>CC</sub> = 6.0 V | -      | -    | 83              | -       | -    | -               | ns/V |

## 9. Static characteristics

**Table 6. Static characteristics**

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

| Symbol          | Parameter                 | Conditions                                                                             | 25 °C |      |      | −40 °C to +85 °C |      | −40 °C to +125 °C |      | Unit |
|-----------------|---------------------------|----------------------------------------------------------------------------------------|-------|------|------|------------------|------|-------------------|------|------|
|                 |                           |                                                                                        | Min   | Typ  | Max  | Min              | Max  | Min               | Max  |      |
| 74HC32          |                           |                                                                                        |       |      |      |                  |      |                   |      |      |
| V <sub>IH</sub> | HIGH-level input voltage  | V <sub>CC</sub> = 2.0 V                                                                | 1.5   | 1.2  | -    | 1.5              | -    | 1.5               | -    | V    |
|                 |                           | V <sub>CC</sub> = 4.5 V                                                                | 3.15  | 2.4  | -    | 3.15             | -    | 3.15              | -    | V    |
|                 |                           | V <sub>CC</sub> = 6.0 V                                                                | 4.2   | 3.2  | -    | 4.2              | -    | 4.2               | -    | V    |
| V <sub>IL</sub> | LOW-level input voltage   | V <sub>CC</sub> = 2.0 V                                                                | -     | 0.8  | 0.5  | -                | 0.5  | -                 | 0.5  | V    |
|                 |                           | V <sub>CC</sub> = 4.5 V                                                                | -     | 2.1  | 1.35 | -                | 1.35 | -                 | 1.35 | V    |
|                 |                           | V <sub>CC</sub> = 6.0 V                                                                | -     | 2.8  | 1.8  | -                | 1.8  | -                 | 1.8  | 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> = −20 μA; V <sub>CC</sub> = 2.0 V                                       | 1.9   | 2.0  | -    | 1.9              | -    | 1.9               | -    | V    |
|                 |                           | I <sub>O</sub> = −20 μA; V <sub>CC</sub> = 4.5 V                                       | 4.4   | 4.5  | -    | 4.4              | -    | 4.4               | -    | V    |
|                 |                           | I <sub>O</sub> = −20 μA; V <sub>CC</sub> = 6.0 V                                       | 5.9   | 6.0  | -    | 5.9              | -    | 5.9               | -    | V    |
|                 |                           | I <sub>O</sub> = −4.0 mA; V <sub>CC</sub> = 4.5 V                                      | 3.98  | 4.32 | -    | 3.84             | -    | 3.7               | -    | V    |
|                 |                           | I <sub>O</sub> = −5.2 mA; V <sub>CC</sub> = 6.0 V                                      | 5.48  | 5.81 | -    | 5.34             | -    | 5.2               | -    | V    |
| 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> = 20 μA; V <sub>CC</sub> = 2.0 V                                        | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V                                        | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V                                        | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V                                       | -     | 0.15 | 0.26 | -                | 0.33 | -                 | 0.4  | V    |
|                 |                           | I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V                                       | -     | 0.16 | 0.26 | -                | 0.33 | -                 | 0.4  | V    |
| I <sub>I</sub>  | input leakage current     | V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V                       | -     | -    | ±0.1 | -                | ±1   | -                 | ±1   | μA   |
| I <sub>CC</sub> | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 6.0 V | -     | -    | 2.0  | -                | 20   | -                 | 40   | μA   |

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

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

| Symbol           | Parameter                 | Conditions                                                                                                                                                       | 25 °C |      |      | –40 °C to +85 °C |      | –40 °C to +125 °C |     | Unit |
|------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------|------|------------------|------|-------------------|-----|------|
|                  |                           |                                                                                                                                                                  | Min   | Typ  | Max  | Min              | Max  | Min               | Max |      |
| C <sub>I</sub>   | input capacitance         |                                                                                                                                                                  | -     | 3.5  | -    | -                | -    | -                 | -   | pF   |
| <b>74HCT32</b>   |                           |                                                                                                                                                                  |       |      |      |                  |      |                   |     |      |
| V <sub>IH</sub>  | HIGH-level input voltage  | V <sub>CC</sub> = 4.5 V to 5.5 V                                                                                                                                 | 2.0   | 1.6  | -    | 2.0              | -    | 2.0               | -   | V    |
| V <sub>IL</sub>  | LOW-level input voltage   | V <sub>CC</sub> = 4.5 V to 5.5 V                                                                                                                                 | -     | 1.2  | 0.8  | -                | 0.8  | -                 | 0.8 | V    |
| V <sub>OH</sub>  | HIGH-level output voltage | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V                                                                                    |       |      |      |                  |      |                   |     |      |
|                  |                           | I <sub>O</sub> = –20 µA                                                                                                                                          | 4.4   | 4.5  | -    | 4.4              | -    | 4.4               | -   | V    |
|                  |                           | I <sub>O</sub> = –4.0 mA                                                                                                                                         | 3.98  | 4.32 | -    | 3.84             | -    | 3.7               | -   | V    |
| V <sub>OL</sub>  | LOW-level output voltage  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V                                                                                    |       |      |      |                  |      |                   |     |      |
|                  |                           | I <sub>O</sub> = 20 µA                                                                                                                                           | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1 | V    |
|                  |                           | I <sub>O</sub> = 5.2 mA                                                                                                                                          | -     | 0.15 | 0.25 | -                | 0.33 | -                 | 0.4 | 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                                                                                              | -     | -    | ±0.1 | -                | ±1   | -                 | ±1  | 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                                                                        | -     | -    | 2.0  | -                | 20   | -                 | 40  | µA   |
| ΔI <sub>CC</sub> | additional supply current | per input pin;<br>V <sub>I</sub> = V <sub>CC</sub> – 2.1 V; I <sub>O</sub> = 0 A;<br>other inputs at V <sub>CC</sub> or GND;<br>V <sub>CC</sub> = 4.5 V to 5.5 V | -     | -    | 430  | -                | 540  | -                 | 590 | µA   |
| C <sub>I</sub>   | input capacitance         |                                                                                                                                                                  | -     | 3.5  | -    | -                | -    | -                 | -   | pF   |

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

$GND = 0\text{ V}$ ;  $C_L = 50\text{ pF}$ ; for test circuit see [Figure 7](#).

| Symbol          | Parameter                     | Conditions                                                                       | 25 °C |     |     | –40 °C to +125 °C |              | Unit |
|-----------------|-------------------------------|----------------------------------------------------------------------------------|-------|-----|-----|-------------------|--------------|------|
|                 |                               |                                                                                  | Min   | Typ | Max | Max (85 °C)       | Max (125 °C) |      |
| 74HC32          |                               |                                                                                  |       |     |     |                   |              |      |
| t <sub>pd</sub> | propagation delay             | nA, nB to nY; see <a href="#">Figure 6</a> <a href="#">[1]</a>                   |       |     |     |                   |              |      |
|                 |                               | V <sub>CC</sub> = 2.0 V                                                          | -     | 22  | 90  | 115               | 135          | ns   |
|                 |                               | V <sub>CC</sub> = 4.5 V                                                          | -     | 8   | 18  | 23                | 27           | ns   |
|                 |                               | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF                                  | -     | 6   | -   | -                 | -            | ns   |
|                 |                               | V <sub>CC</sub> = 6.0 V                                                          | -     | 6   | 15  | 20                | 23           | ns   |
| t <sub>t</sub>  | transition time               | see <a href="#">Figure 6</a> <a href="#">[2]</a>                                 |       |     |     |                   |              |      |
|                 |                               | V <sub>CC</sub> = 2.0 V                                                          | -     | 19  | 75  | 95                | 110          | ns   |
|                 |                               | V <sub>CC</sub> = 4.5 V                                                          | -     | 7   | 15  | 19                | 22           | ns   |
|                 |                               | V <sub>CC</sub> = 6.0 V                                                          | -     | 6   | 13  | 16                | 19           | ns   |
| C <sub>PD</sub> | power dissipation capacitance | per package; V <sub>I</sub> = GND to V <sub>CC</sub> <a href="#">[3]</a>         | -     | 16  | -   | -                 | -            | pF   |
| 74HCT32         |                               |                                                                                  |       |     |     |                   |              |      |
| t <sub>pd</sub> | propagation delay             | nA, nB to nY; see <a href="#">Figure 6</a> <a href="#">[1]</a>                   |       |     |     |                   |              |      |
|                 |                               | V <sub>CC</sub> = 4.5 V                                                          | -     | 11  | 24  | 30                | 36           | ns   |
|                 |                               | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF                                  | -     | 9   | -   | -                 | -            | ns   |
| t <sub>t</sub>  | transition time               | V <sub>CC</sub> = 4.5 V; see <a href="#">Figure 6</a> <a href="#">[2]</a>        | -     | 7   | 15  | 19                | 22           | ns   |
| C <sub>PD</sub> | power dissipation capacitance | per package; V <sub>I</sub> = GND to V <sub>CC</sub> – 1.5 V <a href="#">[3]</a> | -     | 28  | -   | -                 | -            | pF   |

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

[2]  $t_t$  is the same as  $t_{THL}$  and  $t_{TLH}$ .

[3]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ):

$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum (C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

$C_L$  = output load capacitance in pF;

$V_{CC}$  = supply voltage in V;

$N$  = number of inputs switching;

$\sum (C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.

11. Waveforms

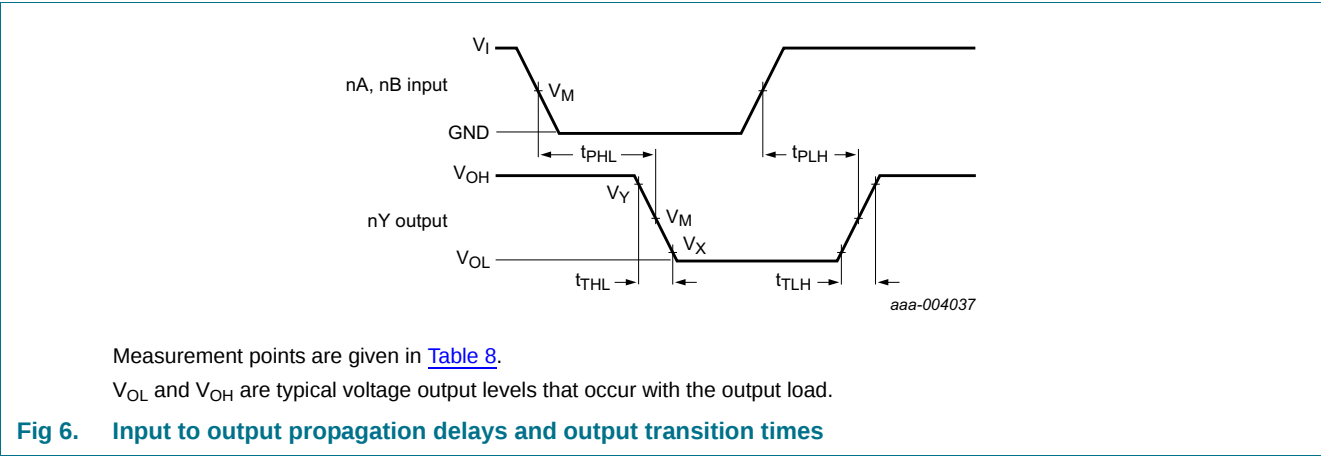
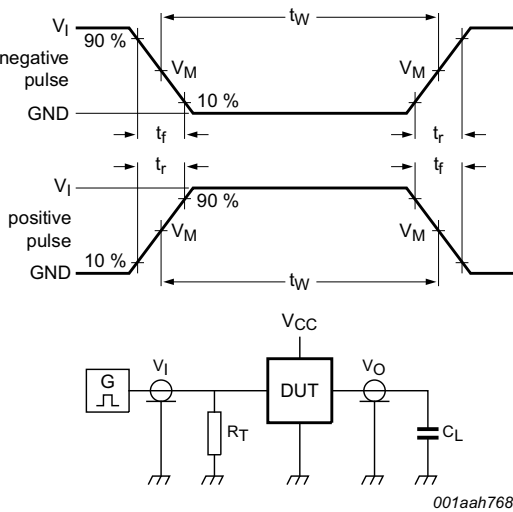


Table 8. Measurement points

| Type    | Input       | Output      |             |             |
|---------|-------------|-------------|-------------|-------------|
|         | $V_M$       | $V_M$       | $V_X$       | $V_Y$       |
| 74HC32  | $0.5V_{CC}$ | $0.5V_{CC}$ | $0.1V_{CC}$ | $0.9V_{CC}$ |
| 74HCT32 | 1.3 V       | 1.3 V       | $0.1V_{CC}$ | $0.9V_{CC}$ |



Test data is given in [Table 9](#).  
Definitions test circuit:  
 $R_T$  = termination resistance should be equal to output impedance  $Z_o$  of the pulse generator.  
 $C_L$  = load capacitance including jig and probe capacitance.

Fig 7. Test circuit for measuring switching times

Table 9. Test data

| Type    | Input    |            | Load         | Test               |
|---------|----------|------------|--------------|--------------------|
|         | $V_I$    | $t_r, t_f$ | $C_L$        |                    |
| 74HC32  | $V_{CC}$ | 6.0 ns     | 15 pF, 50 pF | $t_{PLH}, t_{PHL}$ |
| 74HCT32 | 3.0 V    | 6.0 ns     | 15 pF, 50 pF | $t_{PLH}, t_{PHL}$ |

12. Package outline

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

SOT108-1

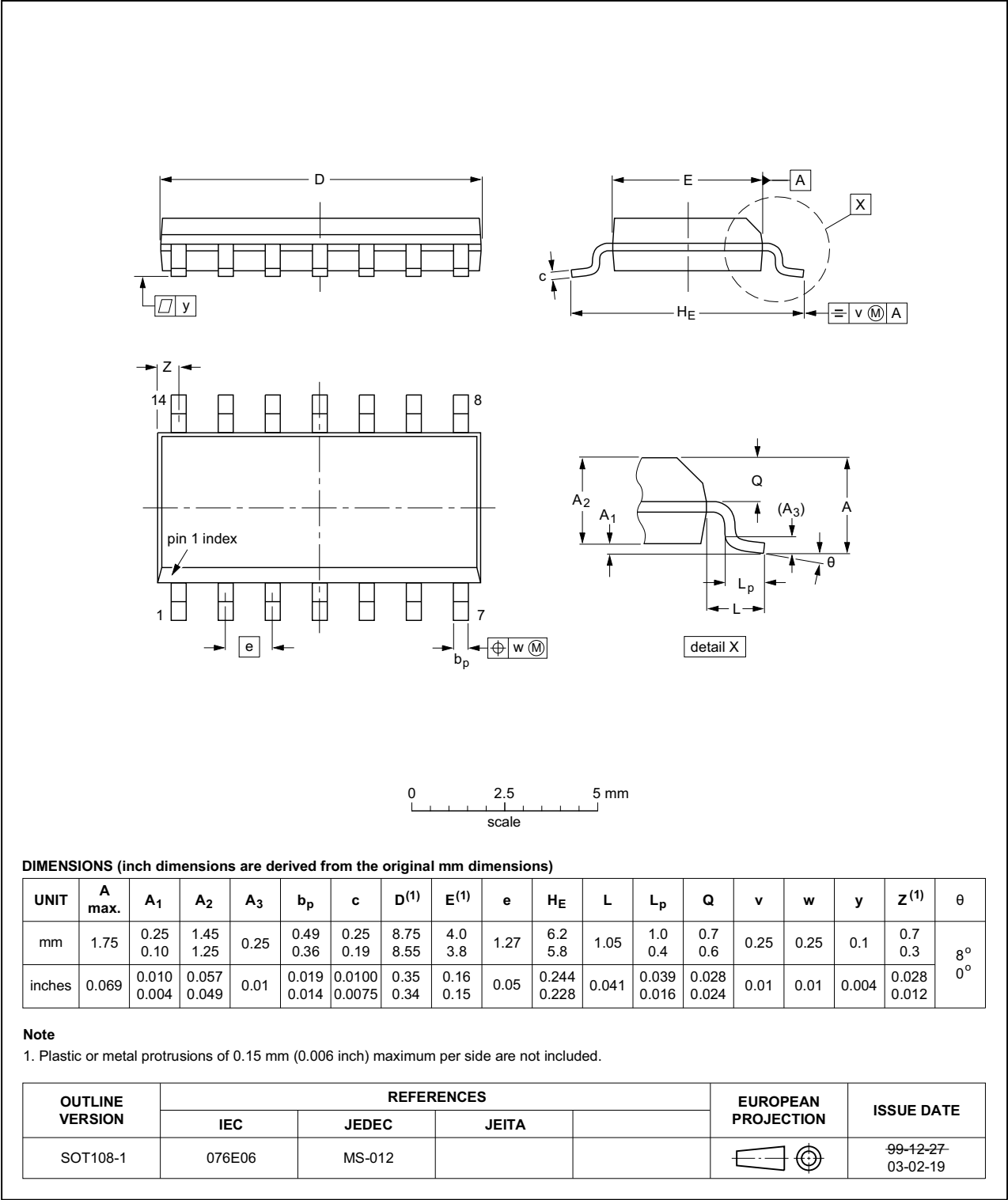


Fig 8. Package outline SOT108-1 (SO14)

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

SOT337-1

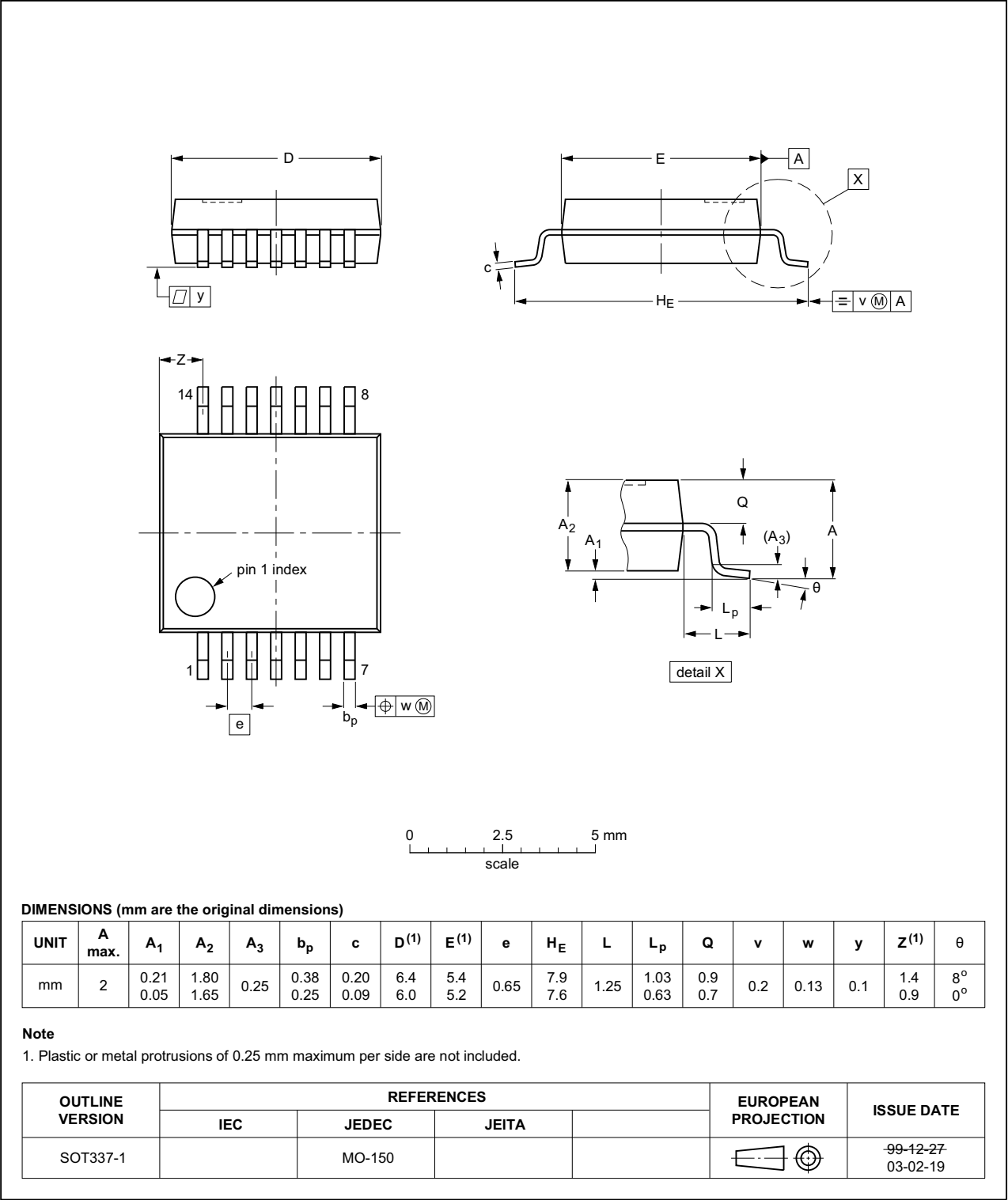


Fig 9. Package outline SOT337-1 (SSOP14)

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

SOT402-1

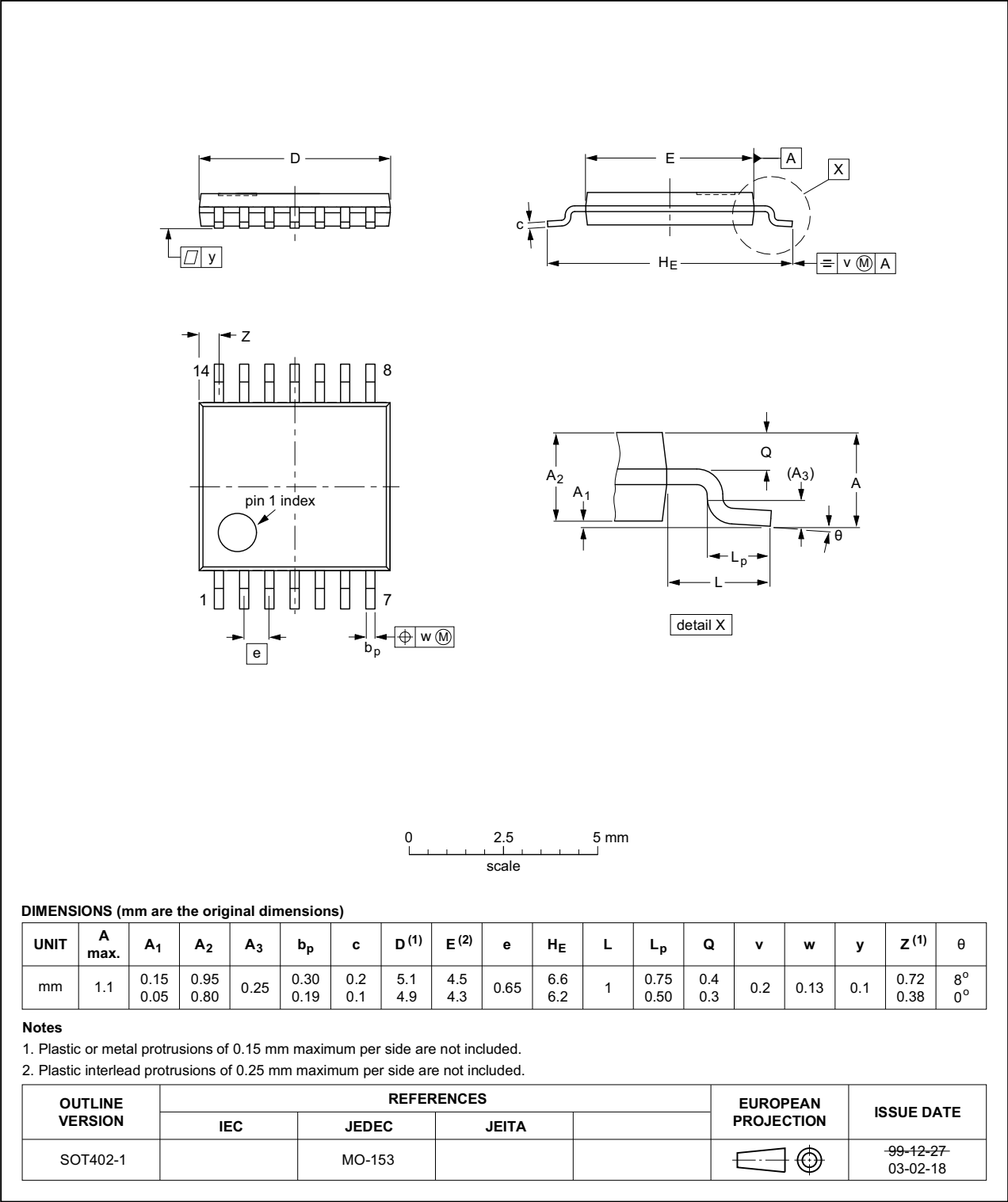


Fig 10. Package outline SOT402-1 (TSSOP14)

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

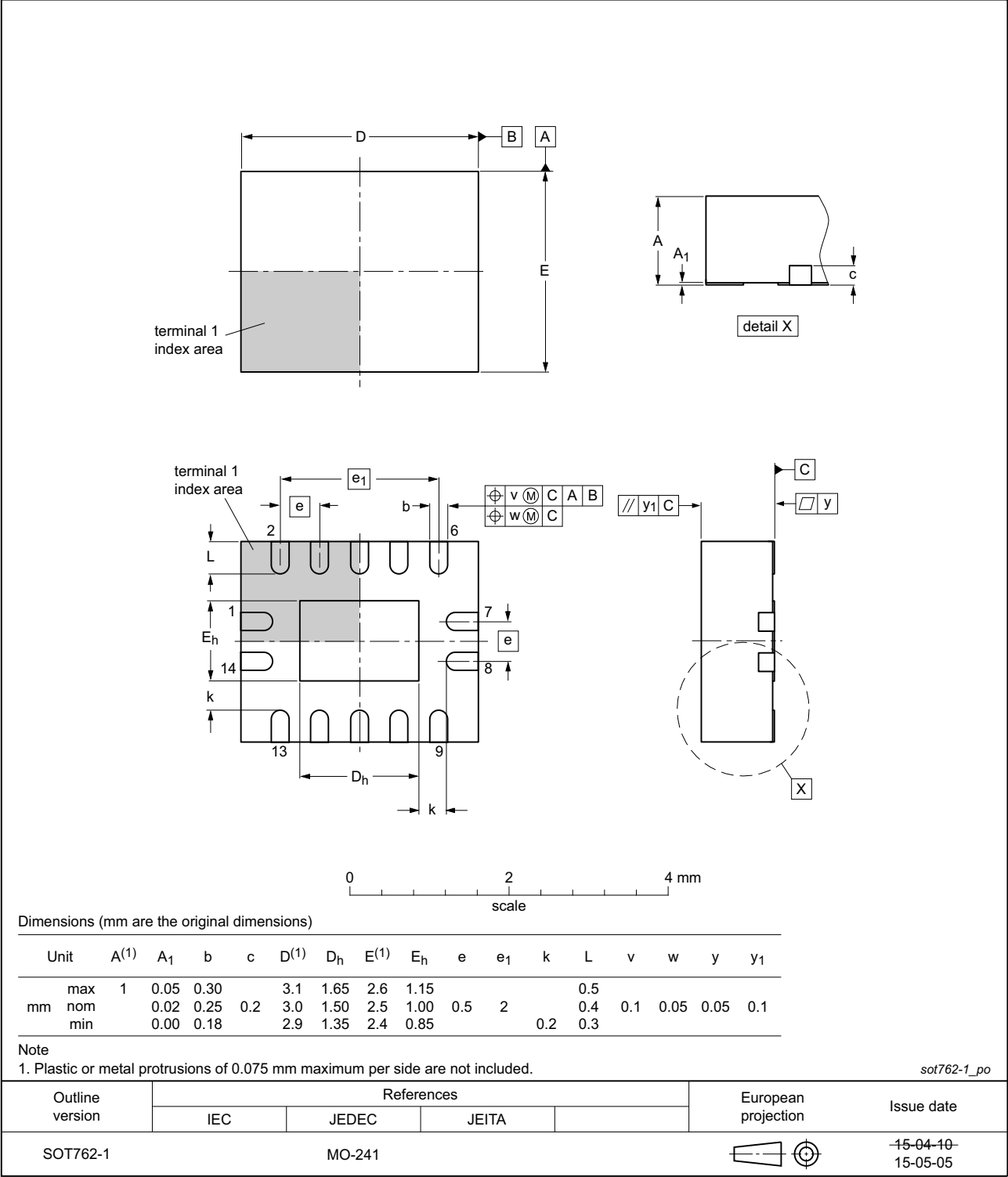


Fig 11. Package outline SOT762-1 (DHVQFN14)

## 13. Abbreviations

Table 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         |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|--------------------|
| 74HC_HCT32 v.6     | 20151203                                                                                                                                                                                                                                             | Product data sheet    | -             | 74HC_HCT32 v.5     |
| Modifications:     | <ul style="list-style-type: none"><li>Type numbers 74HC32N and 74HCT32N (SOT27-1) removed.</li></ul>                                                                                                                                                 |                       |               |                    |
| 74HC_HCT32 v.5     | 20120904                                                                                                                                                                                                                                             | Product data sheet    | -             | 74HC_HCT32 v.4     |
| 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 where appropriate.</li></ul> |                       |               |                    |
| 74HC_HCT32 v.4     | 20031212                                                                                                                                                                                                                                             | Product specification | -             | 74HC_HCT32 v.3     |
| 74HC_HCT32 v.3     | 20030829                                                                                                                                                                                                                                             | Product specification | -             | 74HC_HCT32_CNV v.2 |
| 74HC_HCT32_CNV v.2 | 19970827                                                                                                                                                                                                                                             | 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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