

# 74HC30; 74HCT30

## 8-input NAND gate

Rev. 6 — 27 December 2012

Product data sheet

### 1. General description

The 74HC30; 74HCT30 is an 8-input NAND 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 74HC30: CMOS level
  - ◆ For 74HCT30: TTL level
- 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  $+125\text{ }^{\circ}\text{C}$

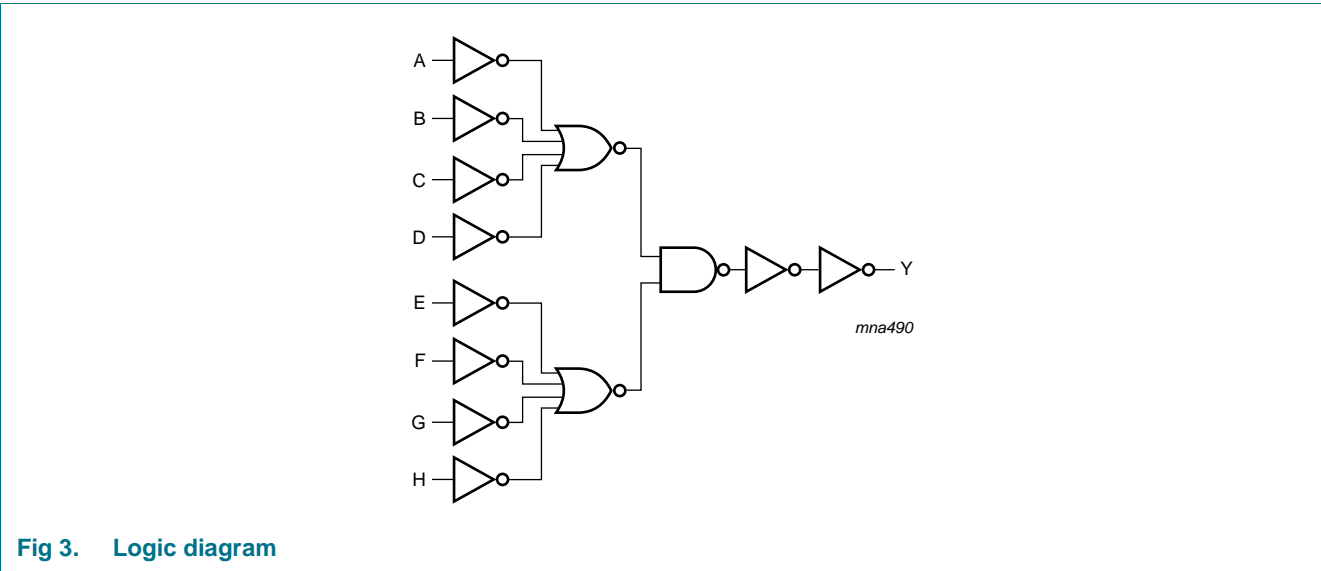
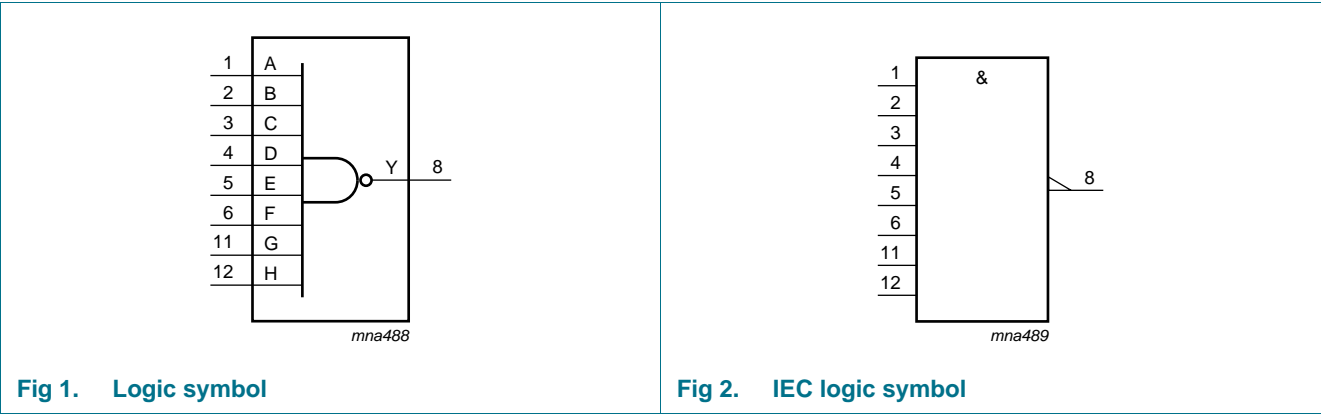
### 3. Ordering information

Table 1. Ordering information

| Type number | Package   |         |  |          |
|-------------|---|---------|--|----------|
|             | Temperature range   | Name    | Description  | Version  |
| 74HC30N     | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | DIP14   | plastic dual in-line package; 14 leads (300 mil)                       | SOT27-1  |
| 74HCT30N    |   |         |  |          |
| 74HC30D     | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SO14    | plastic small outline package; 14 leads; body width 3.9 mm             | SOT108-1 |
| 74HCT30D    |   |         |  |          |
| 74HC30DB    | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SSOP14  | plastic shrink small outline package; 14 leads; body width 5.3 mm      | SOT337-1 |
| 74HCT30DB   |   |         |  |          |
| 74HC30PW    | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | TSSOP14 | plastic thin shrink small outline package; 14 leads; body width 4.4 mm | SOT402-1 |
| 74HCT30PW   |   |         |  |          |

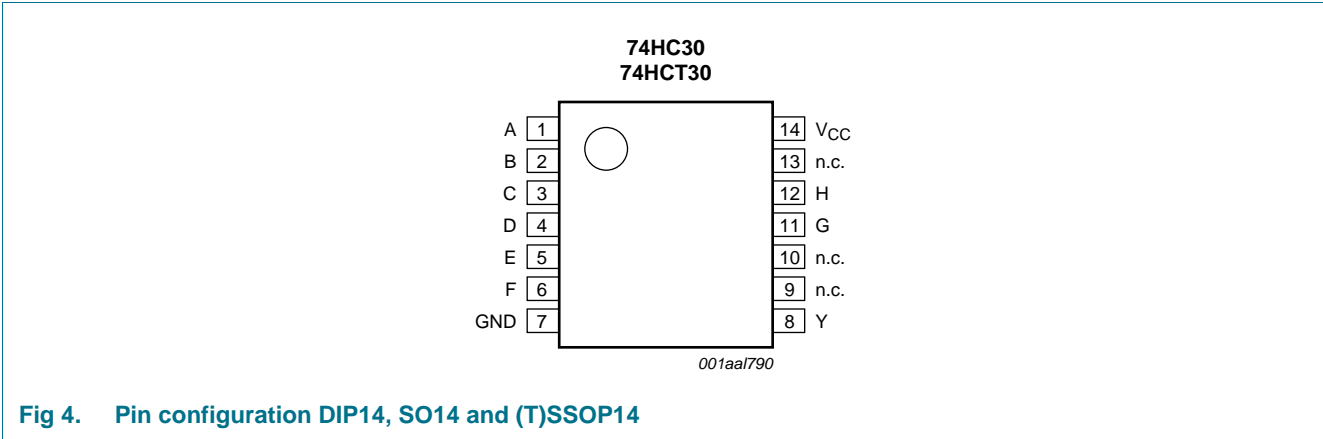


4. Functional diagram



5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

| Symbol          | Pin | Description    |
|-----------------|-----|----------------|
| A               | 1   | data input     |
| B               | 2   | data input     |
| C               | 3   | data input     |
| D               | 4   | data input     |
| E               | 5   | data input     |
| F               | 6   | data input     |
| GND             | 7   | ground (0 V)   |
| Y               | 8   | data output    |
| n.c.            | 9   | not connected  |
| n.c.            | 10  | not connected  |
| G               | 11  | data input     |
| H               | 12  | data input     |
| n.c.            | 13  | not connected  |
| V <sub>CC</sub> | 14  | supply voltage |

## 6. Functional description

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

| Input |   |   |   |   |   |   |   | Output |
|-------|---|---|---|---|---|---|---|--------|
| A     | B | C | D | E | F | G | H | Y      |
| L     | X | X | X | X | X | X | X | H      |
| X     | L | X | X | X | X | X | X | H      |
| X     | X | L | X | X | X | X | X | H      |
| X     | X | X | L | X | X | X | X | H      |
| X     | X | X | X | L | X | X | X | H      |
| X     | X | X | X | X | L | X | X | H      |
| X     | X | X | X | X | X | L | X | H      |
| X     | X | X | X | X | X | X | L | H      |
| H     | H | H | H | H | H | H | H | 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 |
|-----------|--------------------------|--|-------|------|------|
| $V_{CC}$  | supply voltage           |  | -0.5  | +7   | V    |
| $I_{IK}$  | input clamping current   | $V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$ | [1] - | ±20  | mA   |
| $I_{OK}$  | output clamping current  | $V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ | [1] - | ±20  | mA   |
| $I_O$     | output current           | $-0.5\text{ V} < V_O < V_{CC} + 0.5\text{ V}$          | -     | ±25  | mA   |
| $I_{CC}$  | supply current           |  | -     | 50   | mA   |
| $I_{GND}$ | ground current           |  | -50   | -    | mA   |
| $T_{stg}$ | storage temperature      |  | -65   | +150 | °C   |
| $P_{tot}$ | total power dissipation  |  |       |      |      |
|           | DIP14 package            |  | [2] - | 750  | mW   |
|           | SO14, (T)SSOP14 packages |  | [2] - | 500  | mW   |

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

[2] For DIP14 package:  $P_{tot}$  derates linearly with 12 mW/K above 70 °C.

For SO14 package:  $P_{tot}$  derates linearly with 8 mW/K above 70 °C.

For (T)SSOP14 packages:  $P_{tot}$  derates linearly with 5.5 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              | 74HC30 |      |                 | 74HCT30 |      |                 | 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  |      |
| 74HC30          |                           |  |       |      |      |                  |      |                   |      |      |
| 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>74HCT30</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> = 4.0 mA  | -     | 0.15 | 0.26 | -                | 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> – 2.4 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 | -     | 60   | 216  | -                | 275  | -                 | 294 | µA   |
| C <sub>I</sub>   | input capacitance         |  | -     | 3.5  | -    | -                | -    | -                 | -   | pF   |

## 10. Dynamic characteristics

**Table 7.** Dynamic characteristicsGND = 0 V; C<sub>L</sub> = 50 pF; for load circuit see [Figure 6](#).

| Symbol          | Parameter         | Conditions  | 25 °C               |     |     | −40 °C to +125 °C |              | Unit |
|-----------------|-------------------|---|---------------------|-----|-----|-------------------|--------------|------|
|                 |                   |   | Min                 | Typ | Max | Max (85 °C)       | Max (125 °C) |      |
| 74HC30          |                   |   |                     |     |     |                   |              |      |
| t <sub>pd</sub> | propagation delay | A, B, C, D, E, F, G, H to Y; see <a href="#">Figure 5</a> | <a href="#">[1]</a> |     |     |                   |              |      |
|                 |                   | V <sub>CC</sub> = 2.0 V                                   | -                   | 41  | 130 | 165               | 195          | ns   |
|                 |                   | V <sub>CC</sub> = 4.5 V                                   | -                   | 15  | 26  | 33                | 39           | ns   |
|                 |                   | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF           | -                   | 12  | -   | -                 | -            | ns   |
|                 |                   | V <sub>CC</sub> = 6.0 V                                   | -                   | 12  | 22  | 28                | 33           | ns   |
| t <sub>t</sub>  | transition time   | see <a href="#">Figure 5</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   |

**Table 7. Dynamic characteristics ...continued**  
 $GND = 0\text{ V}$ ;  $C_L = 50\text{ pF}$ ; for load circuit see [Figure 6](#).

| Symbol   | Parameter                     | Conditions   | 25 °C |     |     | –40 °C to +125 °C |              | Unit |
|----------|-------------------------------|--|-------|-----|-----|-------------------|--------------|------|
|          |                               |  | Min   | Typ | Max | Max (85 °C)       | Max (125 °C) |      |
| $C_{PD}$ | power dissipation capacitance | per package; $V_I = GND$ to $V_{CC}$ <a href="#">[3]</a> | -     | 15  | -   | -                 | -            | pF   |

|                |                               |   |   |    |    |    |    |    |
|----------------|-------------------------------|---|---|----|----|----|----|----|
| <b>74HCT30</b> |                               |   |   |    |    |    |    |    |
| $t_{pd}$       | propagation delay             | A, B, C, D, E, F, G, H to Y; see <a href="#">Figure 5</a> <a href="#">[1]</a> |   |    |    |    |    |    |
|                |                               | $V_{CC} = 4.5\text{ V}$   | - | 16 | 28 | 35 | 42 | ns |
|                |                               | $V_{CC} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$                                | - | 12 | -  | -  | -  | ns |
| $t_t$          | transition time               | $V_{CC} = 4.5\text{ V}$ ; see <a href="#">Figure 5</a> <a href="#">[2]</a>    | - | 7  | 15 | 19 | 22 | ns |
| $C_{PD}$       | power dissipation capacitance | per package; $V_I = GND$ to $V_{CC} - 1.5\text{ V}$ <a href="#">[3]</a>       | - | 15 | -  | -  | -  | 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;

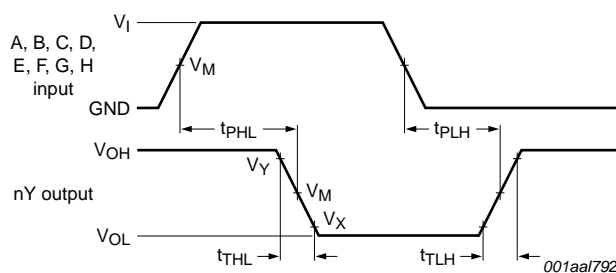
$C_L$  = output load capacitance in pF;

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

$N$  = number of inputs switching;

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

## 11. Waveforms



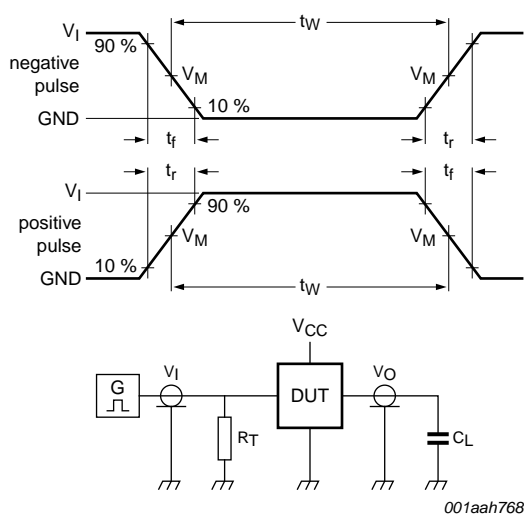
Measurement points are given in [Table 8](#).

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

**Fig 5. Input to output propagation delays**

**Table 8. Measurement points**

| Type    | Input       | Output      |             |             |
|---------|-------------|-------------|-------------|-------------|
|         | $V_M$       | $V_M$       | $V_X$       | $V_Y$       |
| 74HC30  | $0.5V_{CC}$ | $0.5V_{CC}$ | $0.1V_{CC}$ | $0.9V_{CC}$ |
| 74HCT30 | 1.3 V       | 1.3 V       | $0.1V_{CC}$ | $0.9V_{CC}$ |



Test data is given in Table 9.

Definitions for test circuit:

$R_T$  = termination resistance should be equal to the output impedance  $Z_o$  of the pulse generator.

$C_L$  = load capacitance including jig and probe capacitance.

**Fig 6. Test circuit for measuring switching times**

### Table 9. Test data

| Type    | Input           |                                 | Load           | Test                                |
|---------|-----------------|---------------------------------|----------------|-------------------------------------|
|         | V <sub>I</sub>  | t <sub>r</sub> , t <sub>f</sub> | C <sub>L</sub> |                                     |
| 74HC30  | V <sub>CC</sub> | 6.0 ns                          | 15 pF, 50 pF   | t <sub>PLH</sub> , t <sub>PHL</sub> |
| 74HCT30 | 3.0 V           | 6.0 ns                          | 15 pF, 50 pF   | t <sub>PLH</sub> , t <sub>PHL</sub> |



12. Package outline

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

SOT27-1

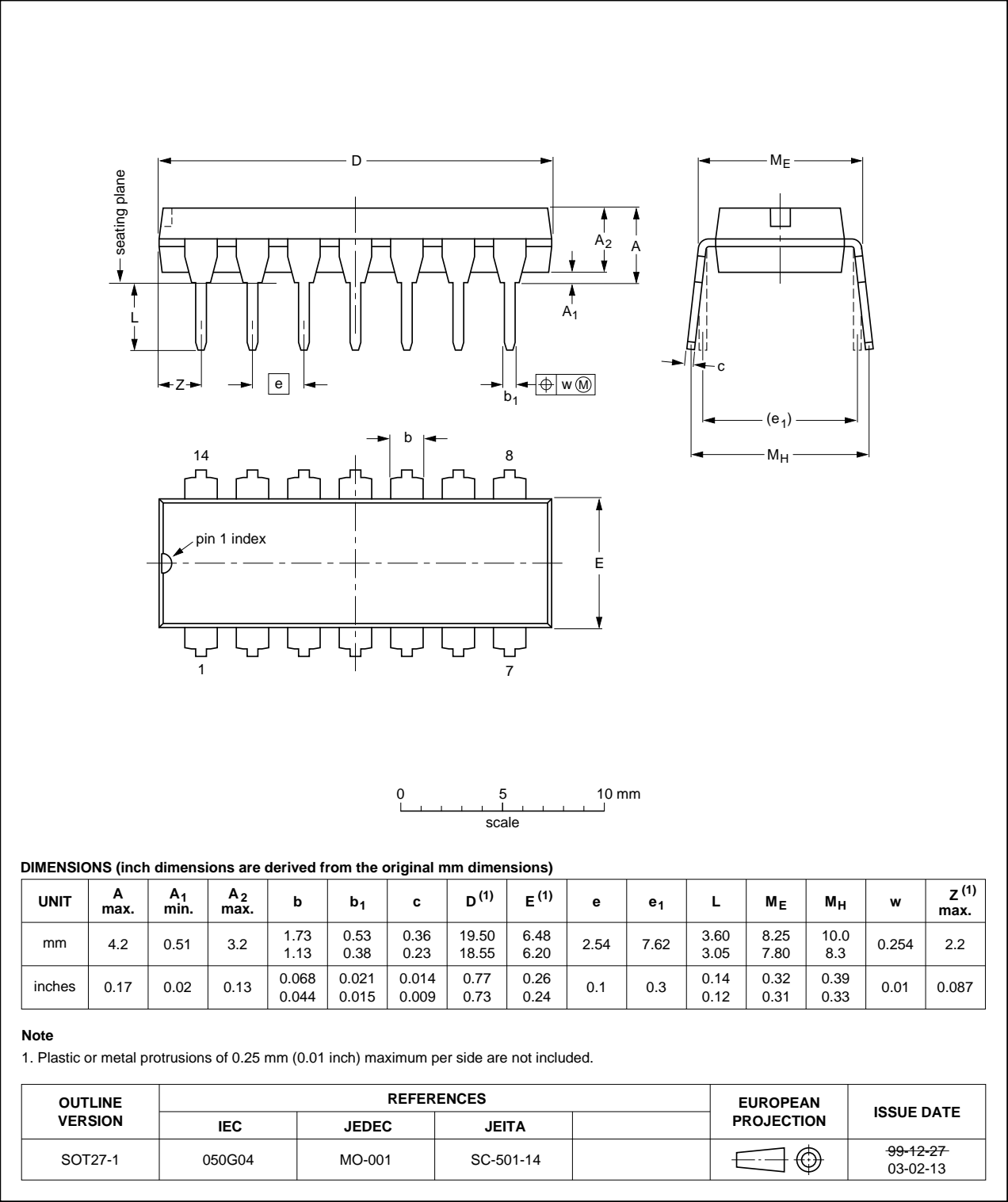


Fig 7. Package outline SOT27-1 (DIP14)

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

SOT108-1

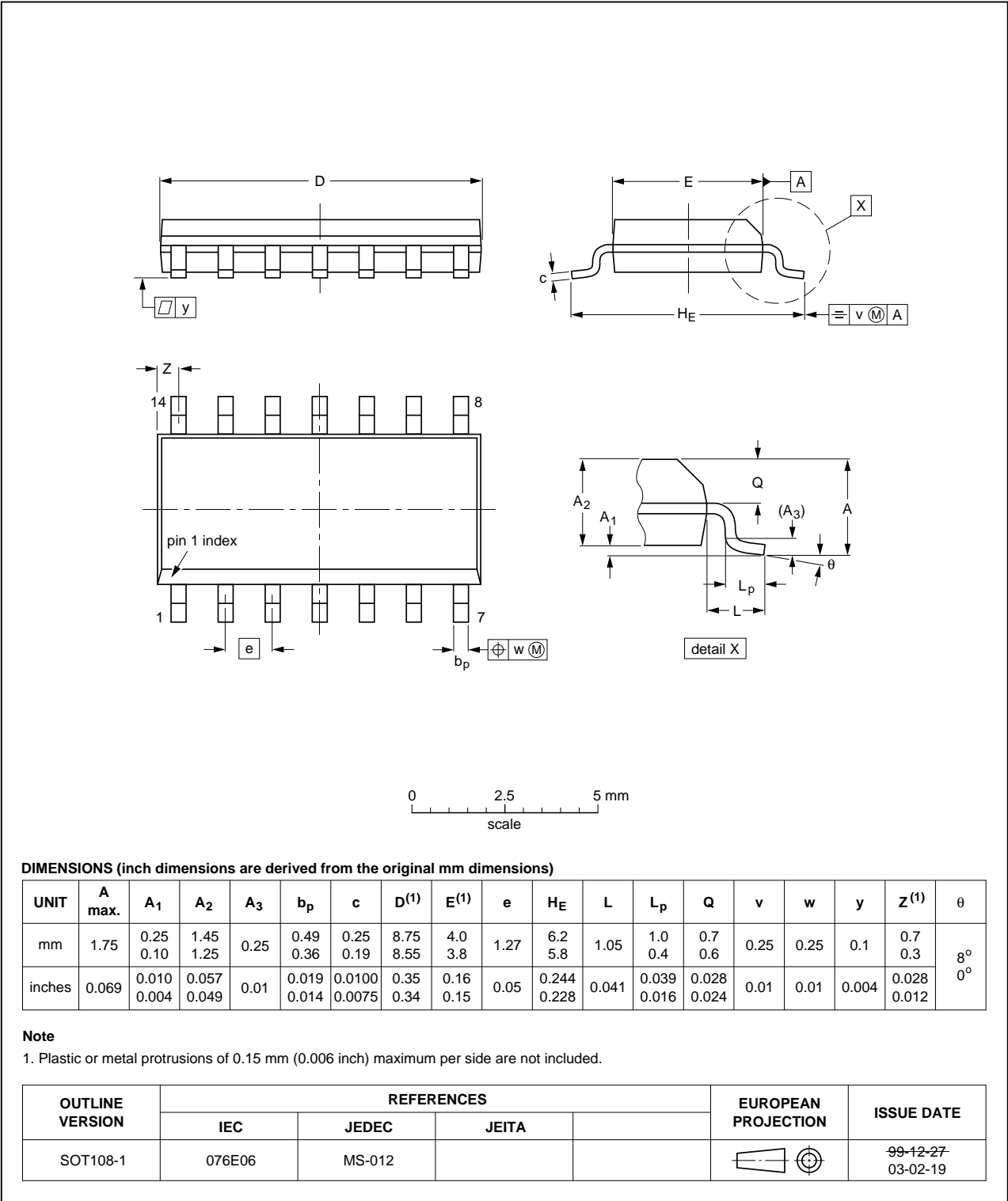


Fig 8. Package outline SOT108-1 (SO14)

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

SOT337-1

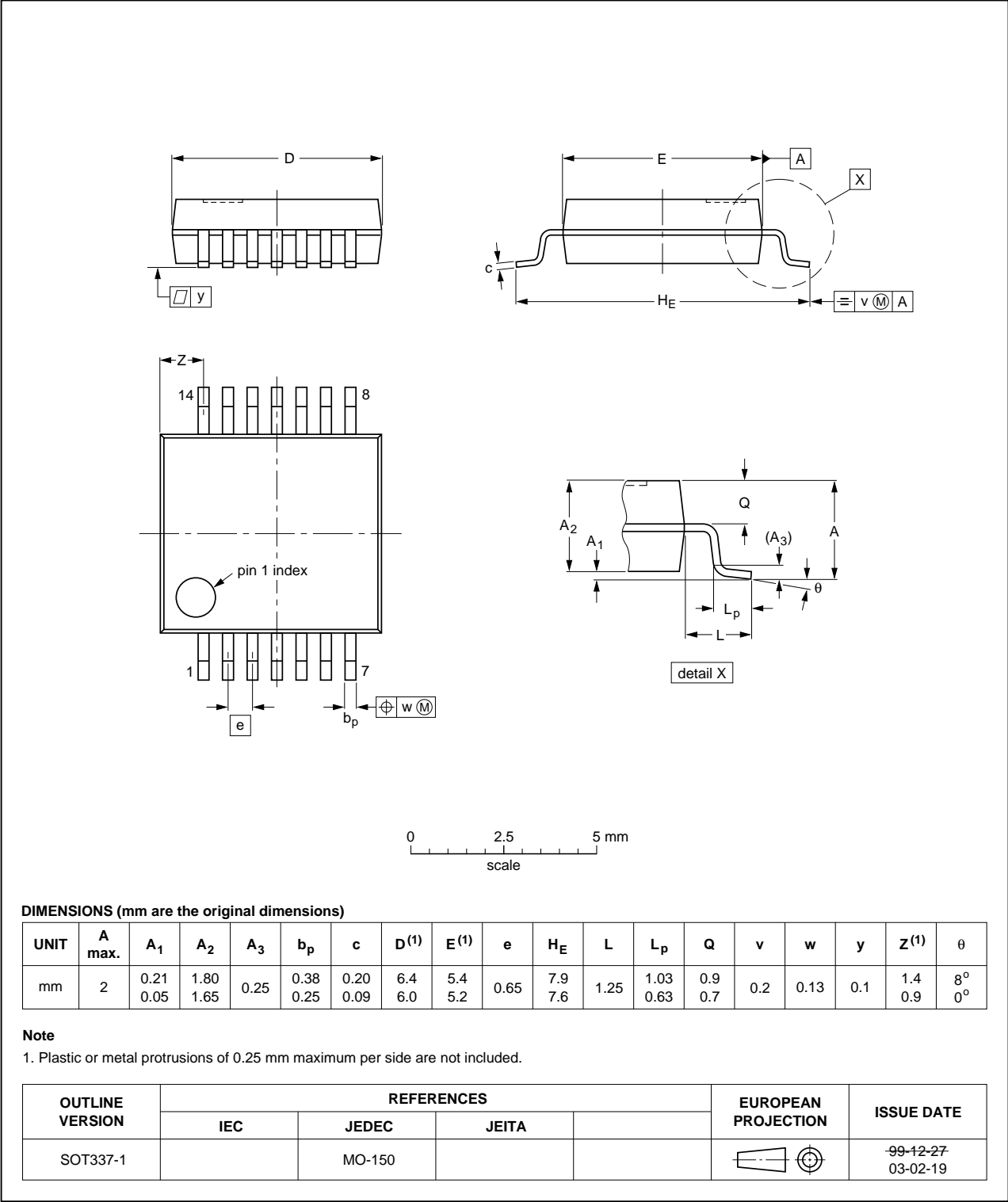


Fig 9. Package outline SOT337-1 (SSOP14)

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

SOT402-1

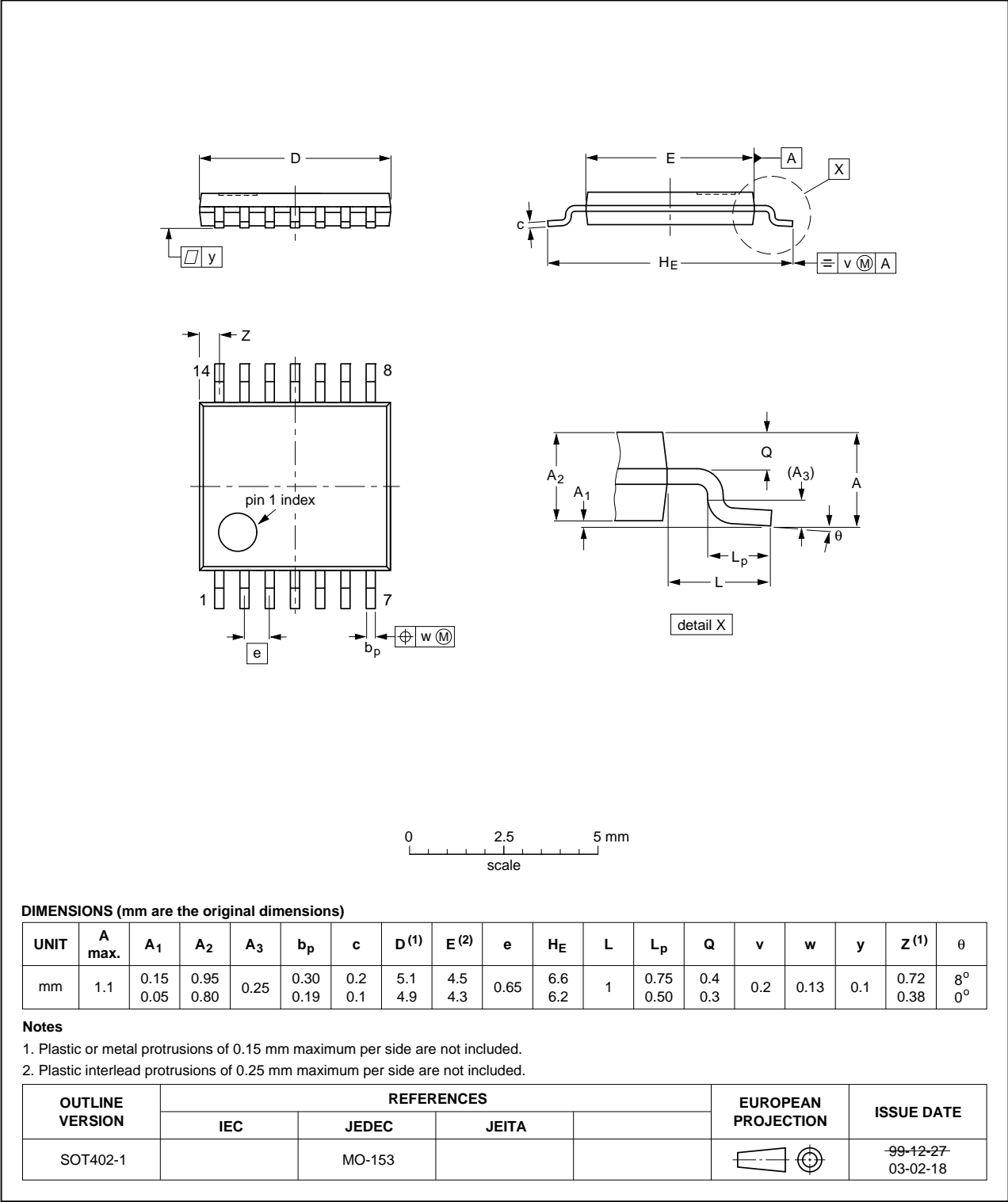


Fig 10. Package outline SOT402-1 (TSSOP14)

## 13. Abbreviations

Table 10. Abbreviations

| Acronym | Description                                    |
|---------|--|
| CMOS    | Complementary Metal-Oxide Semiconductor        |
| DUT     | Device Under Test                              |
| ESD     | ElectroStatic Discharge                        |
| HBM     | Human Body Model                               |
| LSTTL   | Low-power Schottky Transistor-Transistor Logic |
| 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_HCT30 v.6 | 20121227                   | Product data sheet    | -             | 74HC_HCT30 v.5 |
| Modifications: | • New general description. |                       |               |                |
| 74HC_HCT30 v.5 | 20111213                   | Product data sheet    | -             | 74HC_HCT30 v.4 |
| Modifications: | • Legal pages updated.     |                       |               |                |
| 74HC_HCT30 v.4 | 20100504                   | Product data sheet    | -             | 74HC_HCT30 v.3 |
| 74HC_HCT30 v.3 | 20100420                   | Product data sheet    | -             | 74HC_HCT30 v.2 |
| 74HC_HCT30 v.2 | 19970829                   | 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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