

# 74HC30; 74HCT30

## 8-input NAND gate

Rev. 9 — 6 September 2021

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

- Wide supply voltage range from 2.0 V to 6.0 V
- CMOS low power dissipation
- High noise immunity
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Complies with JEDEC standards:
  - JESD8C (2.7 V to 3.6 V)
  - JESD7A (2.0 V to 6.0 V)
- 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
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

## 3. Ordering information

Table 1. Ordering information

| Type number | Package           |         |   |          |
|-------------|-------------------|---------|---|----------|
|             | Temperature range | Name    | Description   | Version  |
| 74HC30D     | -40 °C to +125 °C | SO14    | plastic small outline package; 14 leads;<br>body width 3.9 mm             | SOT108-1 |
| 74HCT30D    |                   |         |   |          |
| 74HC30PW    | -40 °C to +125 °C | TSSOP14 | plastic thin shrink small outline package; 14 leads;<br>body width 4.4 mm | SOT402-1 |
| 74HCT30PW   |                   |         |   |          |

### 4. Functional diagram

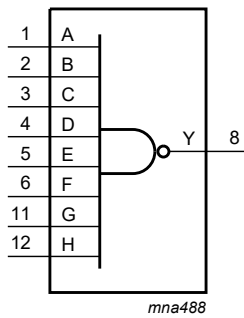


Fig. 1. Logic symbol

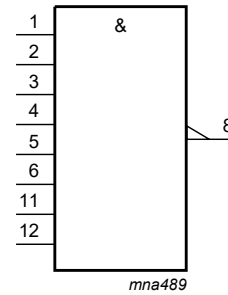


Fig. 2. IEC logic symbol

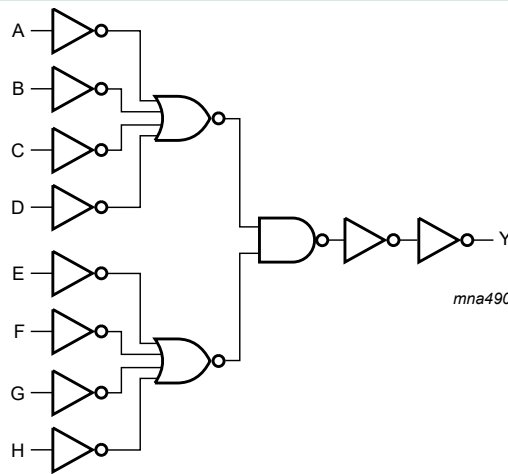


Fig. 3. Logic diagram

### 5. Pinning information

#### 5.1. Pinning

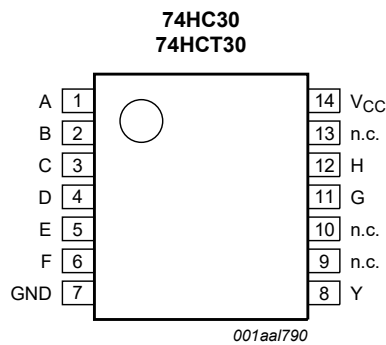


Fig. 4. Pin configuration SOT108-1 (SO14) and SOT402-1 (TSSOP14)

## 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

H = HIGH voltage level; L = LOW voltage level; X = don't care.

| 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      |

## 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] | -    | $\pm 20$ | mA   |
| $I_{OK}$  | output clamping current | $V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ [1] | -    | $\pm 20$ | mA   |
| $I_O$     | output current          | $-0.5\text{ V} < V_O < V_{CC} + 0.5\text{ V}$              | -    | $\pm 25$ | 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 | [2]  | -    | 500      | mW   |

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

[2] For SOT108-1 (SO14) package:  $P_{tot}$  derates linearly with 10.1 mW/K above 100 °C.

For SOT402-1 (TSSOP14) package:  $P_{tot}$  derates linearly with 7.3 mW/K above 81 °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      |      |
| $V_{CC}$            | supply voltage                      |                         | 2.0    | 5.0  | 6.0      | 4.5     | 5.0  | 5.5      | V    |
| $V_I$               | input voltage                       |                         | 0      | -    | $V_{CC}$ | 0       | -    | $V_{CC}$ | V    |
| $V_O$               | output voltage                      |                         | 0      | -    | $V_{CC}$ | 0       | -    | $V_{CC}$ | V    |
| $T_{amb}$           | ambient temperature                 |                         | -40    | -    | +125     | -40     | -    | +125     | °C   |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 2.0\text{ V}$ | -      | -    | 625      | -       | -    | -        | ns/V |
|                     |                                     | $V_{CC} = 4.5\text{ V}$ | -      | 1.67 | 139      | -       | 1.67 | 139      | ns/V |
|                     |                                     | $V_{CC} = 6.0\text{ V}$ | -      | -    | 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  |      |
| <b>74HC30</b>   |                           |  |       |      |      |                  |      |                   |      |      |
| 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    |
| 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>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   |
|                 |                           | 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   |
| C <sub>I</sub>  | input capacitance         |  | -     | 3.5  | -    | -                | -    | -                 | -    | pF   |

| Symbol           | Parameter                 | Conditions  | 25 °C |      |      | -40 °C to +85 °C |      | -40 °C to +125 °C |     | Unit |
|------------------|---------------------------|---|-------|------|------|------------------|------|-------------------|-----|------|
|                  |                           |   | Min   | Typ  | Max  | Min              | Max  | Min               | Max |      |
| <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; 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; V <sub>CC</sub> = 5.5 V  | -     | -    | 2.0  | -                | 20   | -                 | 40  | µA   |
| ΔI <sub>CC</sub> | additional supply current | per input pin; V <sub>I</sub> = V <sub>CC</sub> - 2.4 V; I <sub>O</sub> = 0 A; other inputs at V <sub>CC</sub> or GND; 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 characteristics**

GND = 0 V; C<sub>L</sub> = 50 pF; for test circuit see Fig. 6.

| Symbol          | Parameter                     | Conditions   | 25 °C |     |     | -40 °C to +85 °C |     | -40 °C to +125 °C |     | Unit |
|-----------------|-------------------------------|--|-------|-----|-----|------------------|-----|-------------------|-----|------|
|                 |                               |  | Min   | Typ | Max | Min              | Max | Min               | Max |      |
| <b>74HC30</b>   |                               |  |       |     |     |                  |     |                   |     |      |
| t <sub>pd</sub> | propagation delay             | A, B, C, D, E, F, G, H to Y; [1]<br>see Fig. 5           |       |     |     |                  |     |                   |     |      |
|                 |                               | 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 Fig. 5 [2]   |       |     |     |                  |     |                   |     |      |
|                 |                               | 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> [3] | -     | 15  | -   | -                | -   | -                 | -   | pF   |

| Symbol          | Parameter                     | Conditions   | 25 °C |     |     | -40 °C to +85 °C |     | -40 °C to +125 °C |     | Unit |
|-----------------|-------------------------------|--|-------|-----|-----|------------------|-----|-------------------|-----|------|
|                 |                               |  | Min   | Typ | Max | Min              | Max | Min               | Max |      |
| <b>74HCT30</b>  |                               |  |       |     |     |                  |     |                   |     |      |
| t <sub>pd</sub> | propagation delay             | A, B, C, D, E, F, G, H to Y; [1]<br>see Fig. 5                   |       |     |     |                  |     |                   |     |      |
|                 |                               | V <sub>CC</sub> = 4.5 V  | -     | 16  | 28  | -                | 35  | -                 | 42  | ns   |
|                 |                               | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF                  | -     | 12  | -   | -                | -   | -                 | -   | ns   |
| t <sub>t</sub>  | transition time               | V <sub>CC</sub> = 4.5 V; see Fig. 5 [2]                          | -     | 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 [3] | -     | 15  | -   | -                | -   | -                 | -   | pF   |

- [1] t<sub>pd</sub> is the same as t<sub>PHL</sub> and t<sub>PLH</sub>.
- [2] t<sub>t</sub> is the same as t<sub>THL</sub> and t<sub>TLH</sub>.
- [3] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> 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<sub>i</sub> = input frequency in MHz;  
 f<sub>o</sub> = output frequency in MHz;  
 C<sub>L</sub> = output load capacitance in pF;  
 V<sub>CC</sub> = supply voltage in V;  
 N = number of inputs switching;  
 Σ(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of outputs.

### 10.1. Waveforms and test circuit

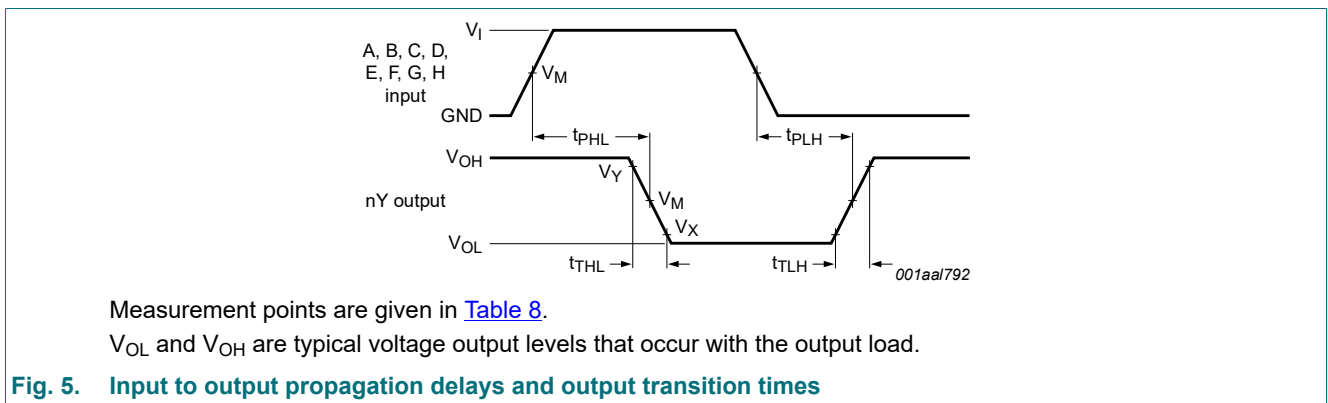


Table 8. Measurement points

| Type    | Input              | Output             |                    |                    |
|---------|--------------------|--------------------|--------------------|--------------------|
|         | V <sub>M</sub>     | V <sub>M</sub>     | V <sub>X</sub>     | V <sub>Y</sub>     |
| 74HC30  | 0.5V <sub>CC</sub> | 0.5V <sub>CC</sub> | 0.1V <sub>CC</sub> | 0.9V <sub>CC</sub> |
| 74HCT30 | 1.3 V              | 1.3 V              | 0.1V <sub>CC</sub> | 0.9V <sub>CC</sub> |



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               |
|---------|----------|------------|--------------|--------------------|
|         | $V_I$    | $t_r, t_f$ | $C_L$        |                    |
| 74HC30  | $V_{CC}$ | 6.0 ns     | 15 pF, 50 pF | $t_{PLH}, t_{PHL}$ |
| 74HCT30 | 3.0 V    | 6.0 ns     | 15 pF, 50 pF | $t_{PLH}, t_{PHL}$ |



11. Package outline

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

SOT108-1

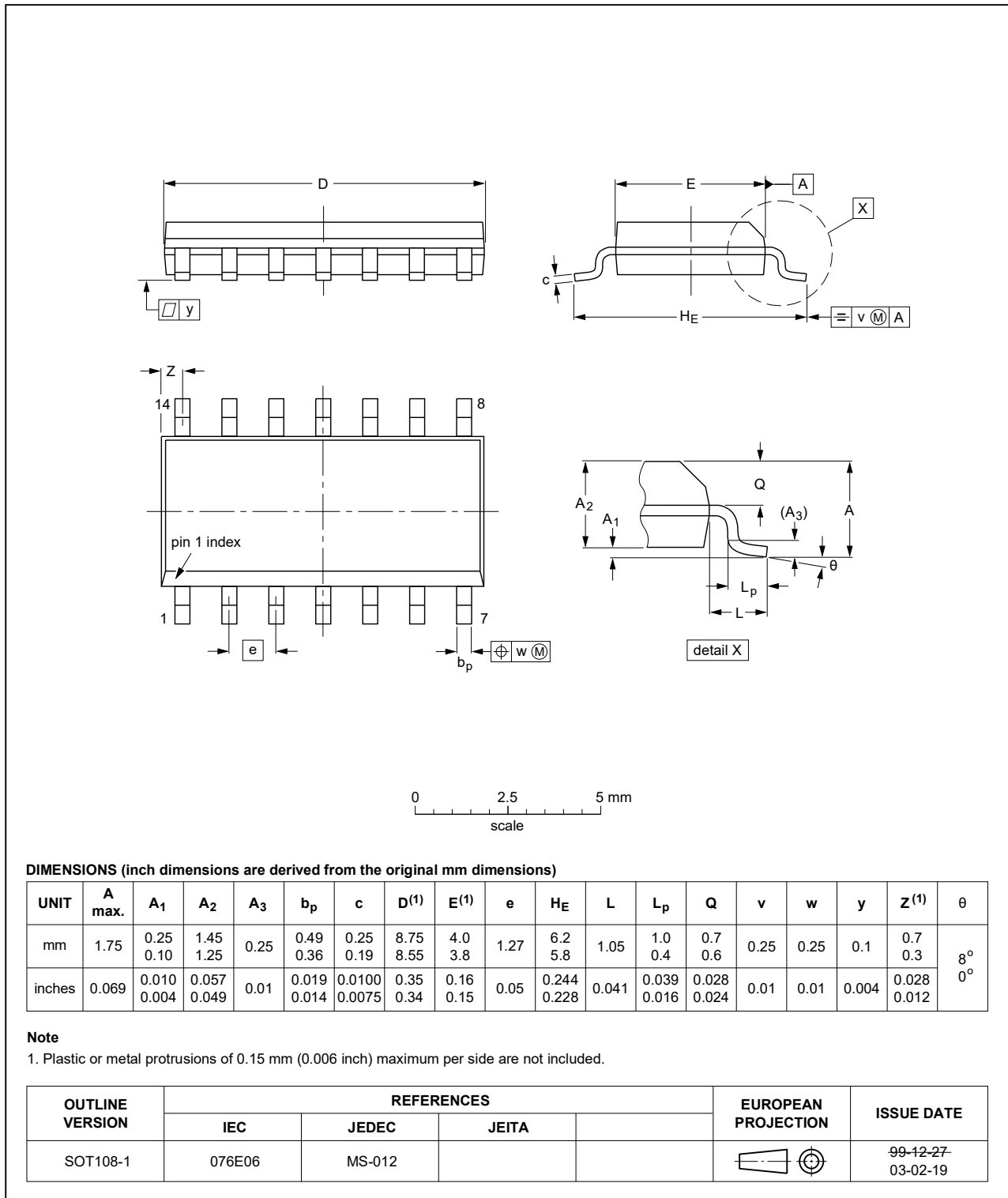


Fig. 7. Package outline SOT108-1 (SO14)

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

SOT402-1



Fig. 8. Package outline SOT402-1 (TSSOP14)

## 12. 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             |

## 13. Revision history

Table 11. Revision history

| Document ID    | Release date  | Data sheet status     | Change notice | Supersedes     |
|----------------|---|-----------------------|---------------|----------------|
| 74HC_HCT30 v.9 | 20210906  | Product data sheet    | -             | 74HC_HCT30 v.8 |
| Modifications: | <ul style="list-style-type: none"> <li>Type number 74HCT30DB (SOT337-1 / SSOP14) removed.</li> </ul>  |                       |               |                |
| 74HC_HCT30 v.8 | 20210209  | Product data sheet    | -             | 74HC_HCT30 v.7 |
| Modifications: | <ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li><a href="#">Section 2</a> updated.</li> <li><a href="#">Section 7</a>: Derating values for <math>P_{tot}</math> total power dissipation have changed.</li> <li>Type number 74HC30DB (SOT337-1 / SSOP14) removed.</li> </ul> |                       |               |                |
| 74HC_HCT30 v.7 | 20151202  | Product data sheet    | -             | 74HC_HCT30 v.6 |
| Modifications: | <ul style="list-style-type: none"> <li>Type numbers 74HC30N and 74HCT30N (SOT27-1) removed.</li> </ul>  |                       |               |                |
| 74HC_HCT30 v.6 | 20121227  | Product data sheet    | -             | 74HC_HCT30 v.5 |
| Modifications: | <ul style="list-style-type: none"> <li>New general description.</li> </ul>  |                       |               |                |
| 74HC_HCT30 v.5 | 20111213  | Product data sheet    | -             | 74HC_HCT30 v.4 |
| Modifications: | <ul style="list-style-type: none"> <li>Legal pages updated.</li> </ul>  |                       |               |                |
| 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 | -             | -              |

## 14. Legal information

### 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 <https://www.nexperia.com>.

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