

# 74HCS04-Q100

## Hex inverter with Schmitt-trigger inputs

Rev. 1 — 24 June 2025

Product data sheet

### 1. General description

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The 74HCS04-Q100 is a hex inverter. The inputs include clamp diodes that enable the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ .

All inputs are Schmitt-trigger inputs, capable of transforming slowly changing input signals into sharply defined, jitter-free output signals.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

### 2. Features and benefits

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- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- Wide supply voltage range from 2.0 V to 6.0 V
- Schmitt-trigger inputs
- Low power consumption
  - Typical supply current ( $I_{CC}$ ) of 100 nA
  - Typical input leakage current ( $I_I$ ) of  $\pm 10$  nA
- $\pm 7.8$  mA output drive at 6 V
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Complies with JEDEC standards:
  - JESD7A (2.0 V to 6.0 V)
- ESD protection:
  - HBM ANSI/ESDA/JEDEC JS-001 class 3A exceeds 4000 V
  - CDM ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1500 V
- Multiple package options
- DHVQFN package with Side-Wettable Flanks enabling Automated Optical Inspection (AOI) of solder joints

### 3. Applications

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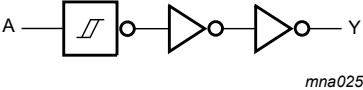
- Wave and pulse shapers
- Astable multivibrators
- Monostable multivibrators

4. Ordering information

Table 1. Ordering information

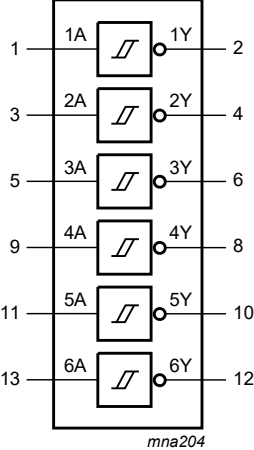
| Type number                    | Package           |          |                                                                                                                              |                          |
|--------------------------------|-------------------|----------|------------------------------------------------------------------------------------------------------------------------------|--------------------------|
|                                | Temperature range | Name     | Description                                                                                                                  | Version                  |
| <a href="#">74HCS04D-Q100</a>  | -40 °C to +125 °C | SO14     | plastic small outline package; 14 leads; body width 3.9 mm                                                                   | <a href="#">SOT108-1</a> |
| <a href="#">74HCS04PW-Q100</a> | -40 °C to +125 °C | TSSOP14  | plastic thin shrink small outline package; 14 leads; body width 4.4 mm                                                       | <a href="#">SOT402-1</a> |
| <a href="#">74HCS04BQ-Q100</a> | -40 °C to +125 °C | DHVQFN14 | plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 × 3 × 0.85 mm | <a href="#">SOT762-1</a> |

5. Functional diagram



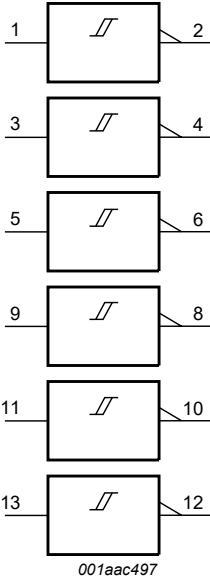
*mna025*

**Fig. 1. Logic diagram (one inverter)**



*mna204*

**Fig. 2. Logic symbol**



*001aac497*

**Fig. 3. IEC logic symbol**

6. Pinning information

6.1. Pinning

**D package**  
**SOT108-1 (SO14)**

aaa-035254

**PW package**  
**SOT402-1 (TSSOP14)**

aaa-035255

**BQ package**  
**SOT762-1 (DHVQFN14)**

terminal 1 index area

GND(1)

Transparent top view

aaa-035256

(1) This is not a ground pin. There is no electrical or mechanical requirement to solder the pad. In case soldered, the solder land should remain floating or connected to GND.

6.2. Pin description

Table 2. Pin description

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

7. Functional description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level.

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

8. 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 [1] | -    | ±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 [1] | -    | ±20   | mA   |
| I <sub>O</sub>   | output current          | V <sub>O</sub> = 0 V to V <sub>CC</sub>                                 | -    | ±35   | mA   |
| I <sub>CC</sub>  | supply current          |                                                                         | -    | 70    | mA   |
| I <sub>GND</sub> | ground current          |                                                                         | -70  | -     | mA   |
| T <sub>j</sub>   | junction temperature    | [2]                                                                     | -    | +150  | °C   |
| T <sub>stg</sub> | storage temperature     |                                                                         | -65  | +150  | °C   |
| V <sub>ESD</sub> | electrostatic discharge | HBM ANSI/ESDA/JEDEC JS-001 class 3A exceeds 4000 V                      | -    | ±4000 | V    |
|                  |                         | CDM ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1500 V                      | -    | ±1500 | V    |
| P <sub>tot</sub> | total power dissipation | [3]                                                                     | -    | 500   | mW   |

- [1] The minimum input and output voltage ratings may be exceeded if the input and output current ratings are observed.
- [2] Guaranteed by design.
- [3] For SOT108-1 (SO14) package: P<sub>tot</sub> derates linearly with 10.1 mW/K above 100 °C.  
For SOT402-1 (TSSOP14) package: P<sub>tot</sub> derates linearly with 7.3 mW/K above 81 °C.  
For SOT762-1 (DHVQFN14) package: P<sub>tot</sub> derates linearly with 9.6 mW/K above 98 °C.

9. Recommended operating conditions

Table 5. Recommended operating conditions

| Symbol           | Parameter           | Conditions | Min | Typ | Max             | Unit |
|------------------|---------------------|------------|-----|-----|-----------------|------|
| V <sub>CC</sub>  | supply voltage      |            | 2.0 | 5.0 | 6.0             | V    |
| V <sub>I</sub>   | input voltage       |            | 0   | -   | V <sub>CC</sub> | V    |
| V <sub>O</sub>   | output voltage      |            | 0   | -   | V <sub>CC</sub> | V    |
| T <sub>amb</sub> | ambient temperature |            | -40 | +25 | +125            | °C   |

## 10. Static characteristics

**Table 6. Static characteristics**

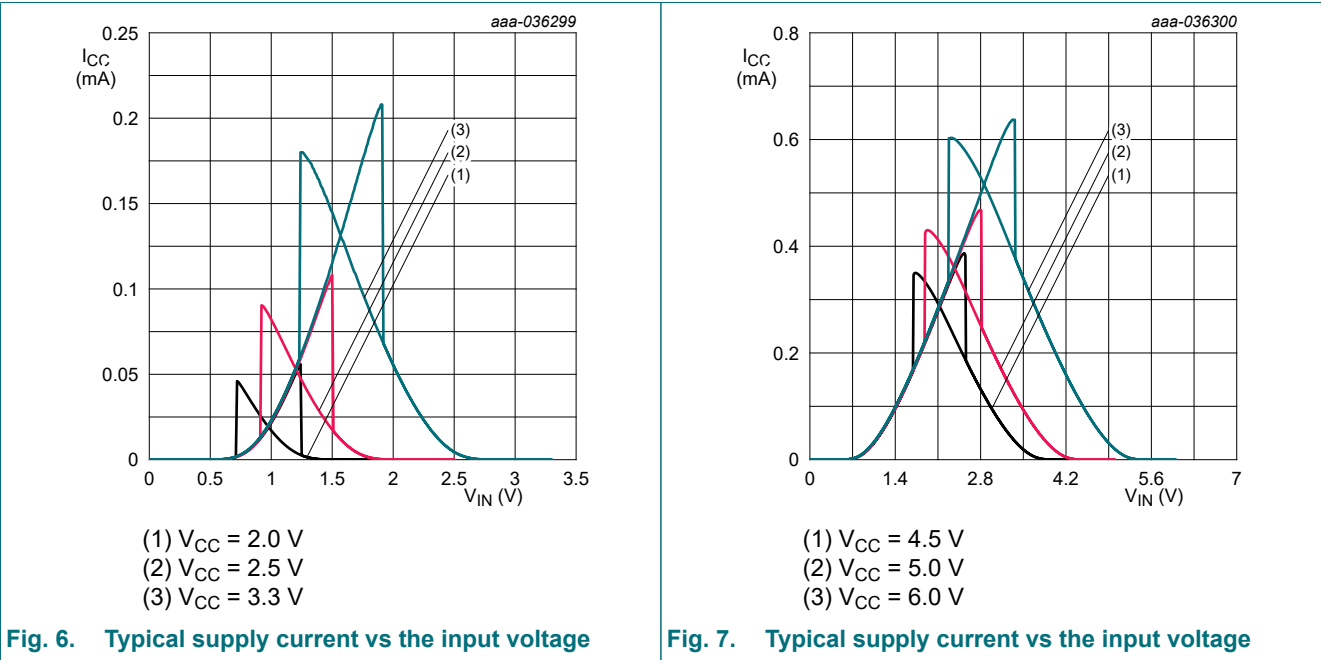
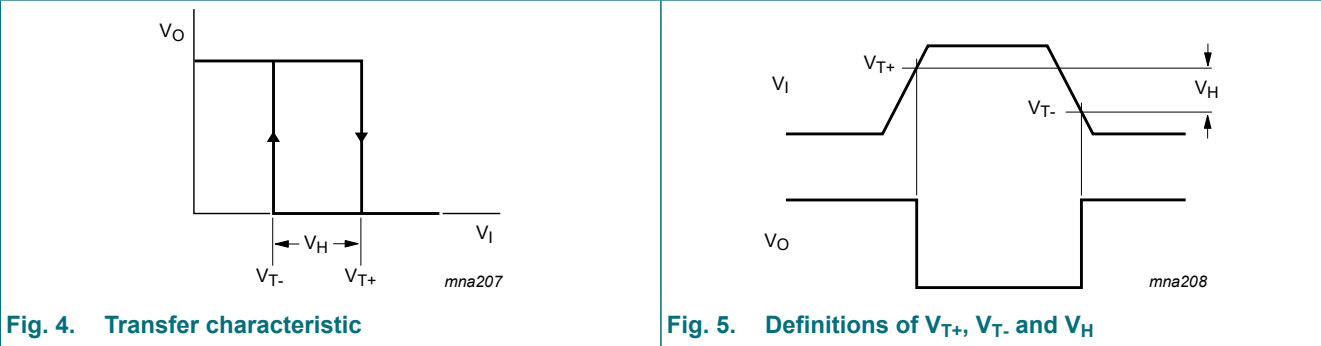
At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

| Symbol          | Parameter                        | Conditions                                                                                | 25 °C                |                        |                     | -40 °C to +85 °C     |                     | -40 °C to +125 °C    |                     | Unit |
|-----------------|----------------------------------|-------------------------------------------------------------------------------------------|----------------------|------------------------|---------------------|----------------------|---------------------|----------------------|---------------------|------|
|                 |                                  |                                                                                           | Min                  | Typ                    | Max                 | Min                  | Max                 | Min                  | Max                 |      |
| V <sub>T+</sub> | positive-going threshold voltage | see Fig. 4 and Fig. 5                                                                     |                      |                        |                     |                      |                     |                      |                     |      |
|                 |                                  | V <sub>CC</sub> = 2.0 V                                                                   | 0.7                  | -                      | 1.5                 | 0.7                  | 1.5                 | 0.7                  | 1.5                 | V    |
|                 |                                  | V <sub>CC</sub> = 4.5 V                                                                   | 1.7                  | -                      | 3.15                | 1.7                  | 3.15                | 1.7                  | 3.15                | V    |
|                 |                                  | V <sub>CC</sub> = 6 V                                                                     | 2.1                  | -                      | 4.2                 | 2.1                  | 4.2                 | 2.1                  | 4.2                 | V    |
|                 |                                  | V <sub>CC</sub> = 3.0 V to 3.6 V                                                          | 0.4V <sub>CC</sub>   | -                      | 0.7V <sub>CC</sub>  | 0.4V <sub>CC</sub>   | 0.7V <sub>CC</sub>  | 0.4V <sub>CC</sub>   | 0.7V <sub>CC</sub>  | V    |
|                 |                                  | V <sub>CC</sub> = 4.5 V to 5.5 V                                                          | 0.38V <sub>CC</sub>  | -                      | 0.7V <sub>CC</sub>  | 0.38V <sub>CC</sub>  | 0.7V <sub>CC</sub>  | 0.38V <sub>CC</sub>  | 0.7V <sub>CC</sub>  | V    |
| V <sub>T-</sub> | negative-going threshold voltage | see Fig. 4 and Fig. 5                                                                     |                      |                        |                     |                      |                     |                      |                     |      |
|                 |                                  | V <sub>CC</sub> = 2.0 V                                                                   | 0.3                  | -                      | 1.0                 | 0.3                  | 1.0                 | 0.3                  | 1.0                 | V    |
|                 |                                  | V <sub>CC</sub> = 4.5 V                                                                   | 0.9                  | -                      | 2.2                 | 0.9                  | 2.2                 | 0.9                  | 2.2                 | V    |
|                 |                                  | V <sub>CC</sub> = 6 V                                                                     | 1.2                  | -                      | 3.0                 | 1.2                  | 3.0                 | 1.2                  | 3.0                 | V    |
|                 |                                  | V <sub>CC</sub> = 3.0 V to 3.6 V                                                          | 0.2V <sub>CC</sub>   | -                      | 0.5V <sub>CC</sub>  | 0.2V <sub>CC</sub>   | 0.5V <sub>CC</sub>  | 0.2V <sub>CC</sub>   | 0.5V <sub>CC</sub>  | V    |
|                 |                                  | V <sub>CC</sub> = 4.5 V to 5.5 V                                                          | 0.2V <sub>CC</sub>   | -                      | 0.49V <sub>CC</sub> | 0.2V <sub>CC</sub>   | 0.49V <sub>CC</sub> | 0.2V <sub>CC</sub>   | 0.49V <sub>CC</sub> | V    |
| V <sub>H</sub>  | hysteresis voltage[1]            | see Fig. 4 and Fig. 5                                                                     |                      |                        |                     |                      |                     |                      |                     |      |
|                 |                                  | V <sub>CC</sub> = 2.0 V                                                                   | 0.2                  | 0.52                   | 1.0                 | 0.2                  | 1.0                 | 0.2                  | 1.0                 | V    |
|                 |                                  | V <sub>CC</sub> = 4.5 V                                                                   | 0.4                  | 0.85                   | 1.4                 | 0.4                  | 1.4                 | 0.4                  | 1.4                 | V    |
|                 |                                  | V <sub>CC</sub> = 6 V                                                                     | 0.6                  | 1.1                    | 1.6                 | 0.6                  | 1.6                 | 0.6                  | 1.6                 | V    |
|                 |                                  | V <sub>CC</sub> = 3.0 V to 3.6 V                                                          | 0.1V <sub>CC</sub>   | 0.72                   | 0.38V <sub>CC</sub> | 0.1V <sub>CC</sub>   | 0.38V <sub>CC</sub> | 0.1V <sub>CC</sub>   | 0.38V <sub>CC</sub> | V    |
|                 |                                  | V <sub>CC</sub> = 4.5 V to 5.5 V                                                          | 0.09V <sub>CC</sub>  | 0.94                   | 0.29V <sub>CC</sub> | 0.09V <sub>CC</sub>  | 0.29V <sub>CC</sub> | 0.09V <sub>CC</sub>  | 0.29V <sub>CC</sub> | V    |
| V <sub>OH</sub> | HIGH-level output voltage        | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                       |                      |                        |                     |                      |                     |                      |                     |      |
|                 |                                  | I <sub>OH</sub> = -20 µA;<br>V <sub>CC</sub> = 2.0 V to 6 V                               | V <sub>CC</sub> -0.1 | V <sub>CC</sub> -0.002 | -                   | V <sub>CC</sub> -0.1 | -                   | V <sub>CC</sub> -0.1 | -                   | V    |
|                 |                                  | I <sub>OH</sub> = -4 mA;<br>V <sub>CC</sub> = 3.0 V                                       | 2.7                  | 2.85                   | -                   | 2.7                  | -                   | 2.7                  | -                   | V    |
|                 |                                  | I <sub>OH</sub> = -6 mA;<br>V <sub>CC</sub> = 4.5 V                                       | 4.0                  | 4.3                    | -                   | 4.0                  | -                   | 4.0                  | -                   | V    |
|                 |                                  | I <sub>OH</sub> = -7.8 mA;<br>V <sub>CC</sub> = 6.0 V                                     | 5.48                 | 5.75                   | -                   | 5.4                  | -                   | 5.4                  | -                   | V    |
| V <sub>OL</sub> | LOW-level output voltage         | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                       |                      |                        |                     |                      |                     |                      |                     |      |
|                 |                                  | I <sub>OL</sub> = 20 µA;<br>V <sub>CC</sub> = 2.0 V to 6 V                                | -                    | 0.002                  | 0.1                 | -                    | 0.1                 | -                    | 0.1                 | V    |
|                 |                                  | I <sub>OL</sub> = 4 mA;<br>V <sub>CC</sub> = 3.0 V                                        | -                    | 0.14                   | 0.25                | -                    | 0.25                | -                    | 0.25                | V    |
|                 |                                  | I <sub>OL</sub> = 6 mA;<br>V <sub>CC</sub> = 4.5 V                                        | -                    | 0.18                   | 0.26                | -                    | 0.30                | -                    | 0.30                | V    |
|                 |                                  | I <sub>OL</sub> = 7.8 mA;<br>V <sub>CC</sub> = 6.0 V                                      | -                    | 0.22                   | 0.26                | -                    | 0.33                | -                    | 0.33                | V    |
| I <sub>I</sub>  | input leakage current            | V <sub>I</sub> = V <sub>CC</sub> or GND;<br>V <sub>CC</sub> = 6.0 V                       | -                    | ±0.01                  | ±0.1                | -                    | ±0.25               | -                    | ±1.0                | µA   |
| I <sub>CC</sub> | supply current                   | V <sub>I</sub> = V <sub>CC</sub> or GND;<br>I <sub>O</sub> = 0 A; V <sub>CC</sub> = 6.0 V | -                    | 0.1                    | -                   | -                    | 0.5                 | -                    | 2.0                 | µA   |

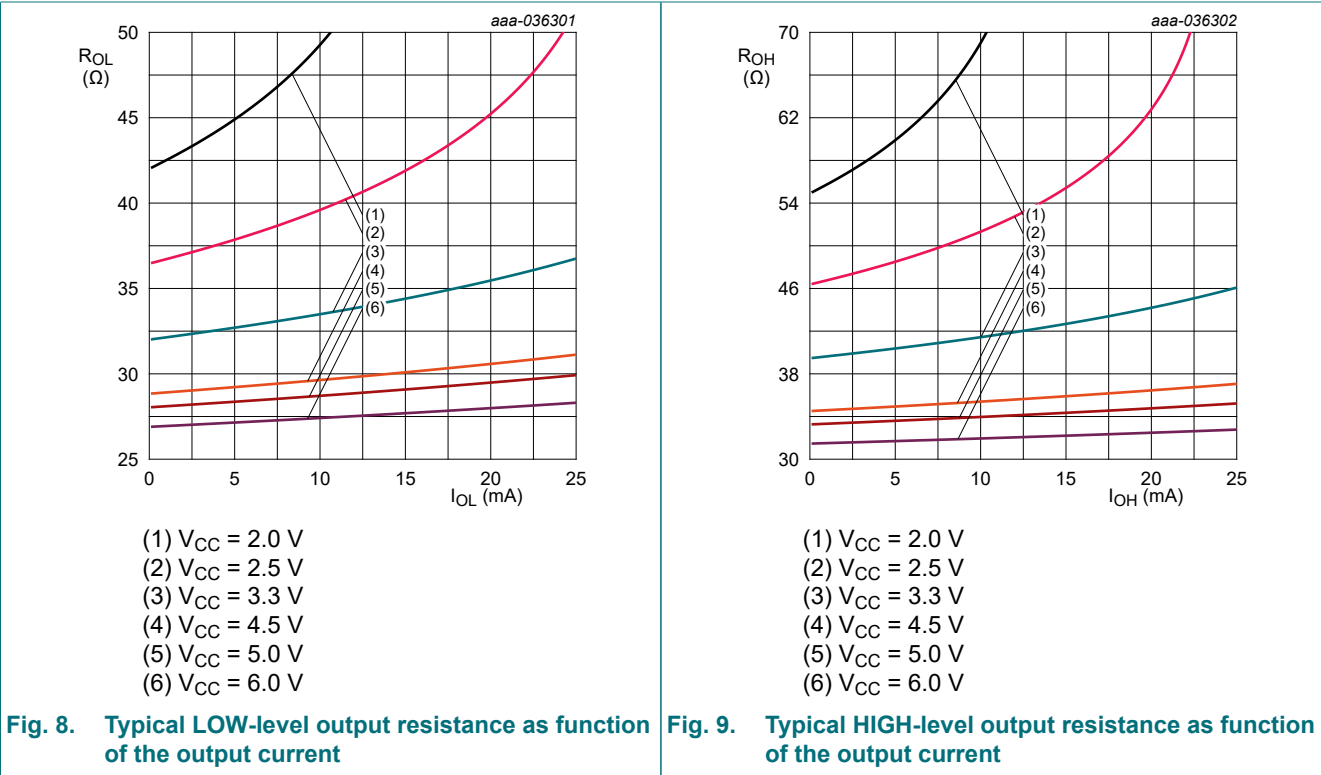
[1] Guaranteed by design.

10.1. Transfer characteristic waveforms and graphs

10.1.1. For inputs



10.1.2. For outputs



11. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see [Section 11.1](#).

| Symbol   | Parameter         | Conditions                                | 25 °C |        |     | -40 °C to +85 °C |     | -40 °C to +125 °C |     | Unit |
|----------|-------------------|-------------------------------------------|-------|--------|-----|------------------|-----|-------------------|-----|------|
|          |                   |                                           | Min   | Typ[1] | Max | Min              | Max | Min               | Max |      |
| $t_{pd}$ | propagation delay | nA to nY; see <a href="#">Fig. 10</a> [2] |       |        |     |                  |     |                   |     |      |
|          |                   | $V_{CC} = 2\text{ V}$                     | -     | 15     | 32  | -                | 38  | -                 | 40  | ns   |
|          |                   | $V_{CC} = 4.5\text{ V}$                   | -     | 6      | 14  | -                | 16  | -                 | 17  | ns   |
|          |                   | $V_{CC} = 6\text{ V}$                     | -     | 5      | 14  | -                | 15  | -                 | 16  | ns   |
|          |                   | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$   | -     | 6      | 20  | -                | 23  | -                 | 24  | ns   |
|          |                   | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$   | -     | 5      | 14  | -                | 16  | -                 | 17  | ns   |
| $t_t$    | transition time   | nY; see <a href="#">Fig. 10</a> [3]       |       |        |     |                  |     |                   |     |      |
|          |                   | $V_{CC} = 2\text{ V}$                     | -     | 9      | 13  | -                | 15  | -                 | 16  | ns   |
|          |                   | $V_{CC} = 4.5\text{ V}$                   | -     | 5      | 7   | -                | 8   | -                 | 8   | ns   |
|          |                   | $V_{CC} = 6\text{ V}$                     | -     | 4      | 6   | -                | 7   | -                 | 7   | ns   |
|          |                   | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$   | -     | 5      | 8   | -                | 9   | -                 | 10  | ns   |
|          |                   | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$   | -     | 4      | 7   | -                | 8   | -                 | 8   | ns   |
| $C_i$    | input capacitance |                                           | -     | 1.5    | -   | -                | 5   | -                 | 5   | pF   |

| Symbol          | Parameter                     | Conditions                                                                                                                      | 25 °C |        |     | -40 °C to +85 °C |     | -40 °C to +125 °C |     | Unit |
|-----------------|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-------|--------|-----|------------------|-----|-------------------|-----|------|
|                 |                               |                                                                                                                                 | Min   | Typ[1] | Max | Min              | Max | Min               | Max |      |
| C <sub>PD</sub> | power dissipation capacitance | f <sub>i</sub> = 1 MHz; C <sub>L</sub> = 0 pF;<br>V <sub>I</sub> = GND to V <sub>CC</sub> ;<br>V <sub>CC</sub> = 2.0 V to 6.0 V | -     | 10     | -   | -                | -   | -                 | -   | pF   |

- [1] Typical values are measured at nominal supply voltage.
- [2] t<sub>pd</sub> is the same as t<sub>PHL</sub> and t<sub>PLH</sub>.
- [3] t<sub>i</sub> is the same as t<sub>THL</sub> and t<sub>TLH</sub>.
- [4] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i + \Sigma(C_L \times V_{CC}^2 \times f_o)$  where:  
f<sub>i</sub> = input frequency in MHz;  
f<sub>o</sub> = output frequency in MHz;  
 $\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of outputs;  
C<sub>L</sub> = output load capacitance in pF;  
V<sub>CC</sub> = supply voltage in V.

11.1. Waveforms and test circuit

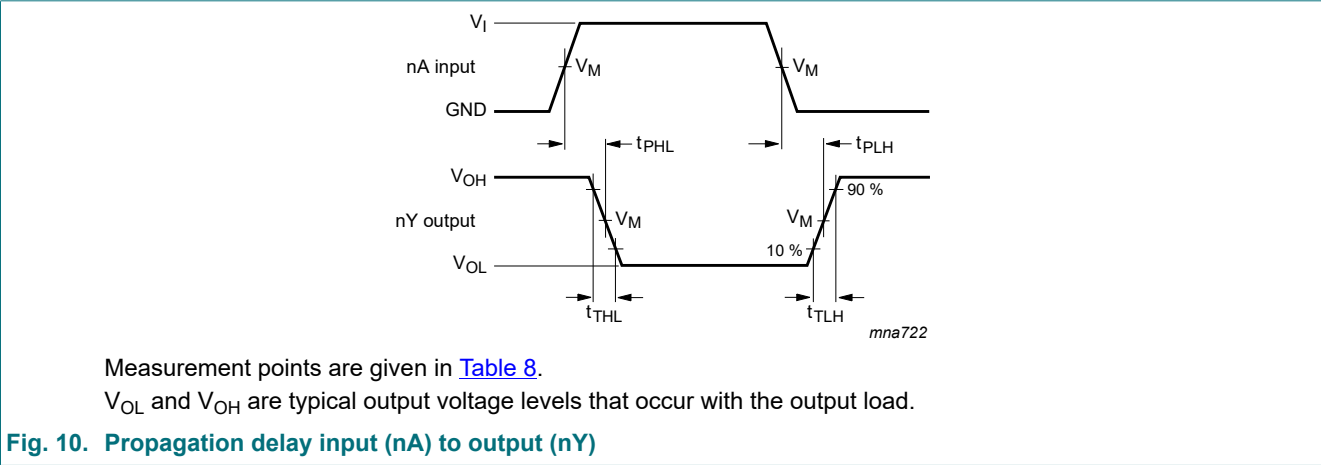


Table 8. Measurement points

| Input              | Output             |
|--------------------|--------------------|
| V <sub>M</sub>     | V <sub>M</sub>     |
| 0.5V <sub>CC</sub> | 0.5V <sub>CC</sub> |



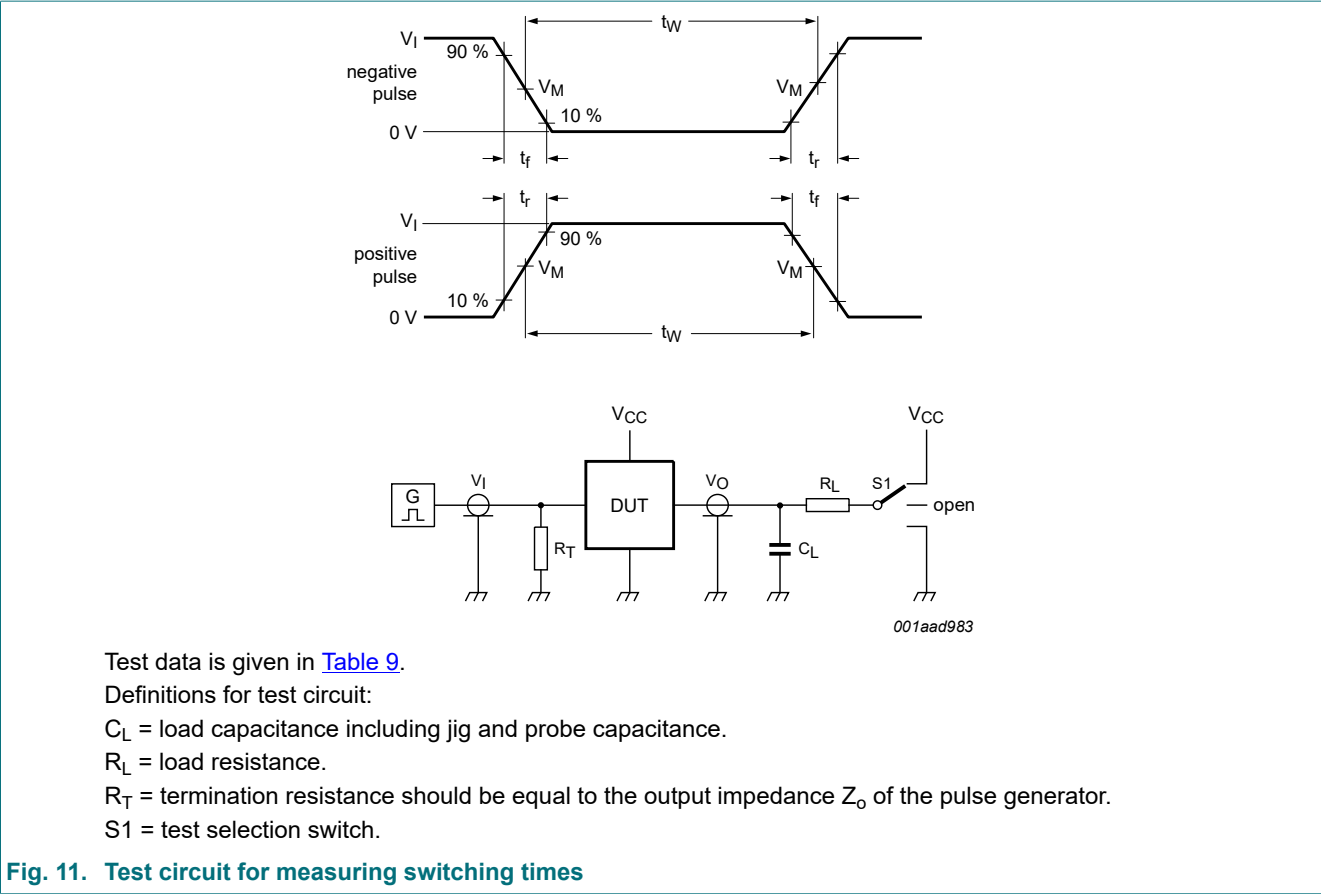


Fig. 11. Test circuit for measuring switching times

Table 9. Test data

| Input    |            | Load  |       | S1 position        |                    |                    |
|----------|------------|-------|-------|--------------------|--------------------|--------------------|
| $V_I$    | $t_r, t_f$ | $C_L$ | $R_L$ | $t_{PHL}, t_{PLH}$ | $t_{PZH}, t_{PHZ}$ | $t_{PZL}, t_{PLZ}$ |
| $V_{CC}$ | 2.5 ns     | 50 pF | 1 kΩ  | open               | GND                | $V_{CC}$           |

12. Package outline

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

SOT108-1

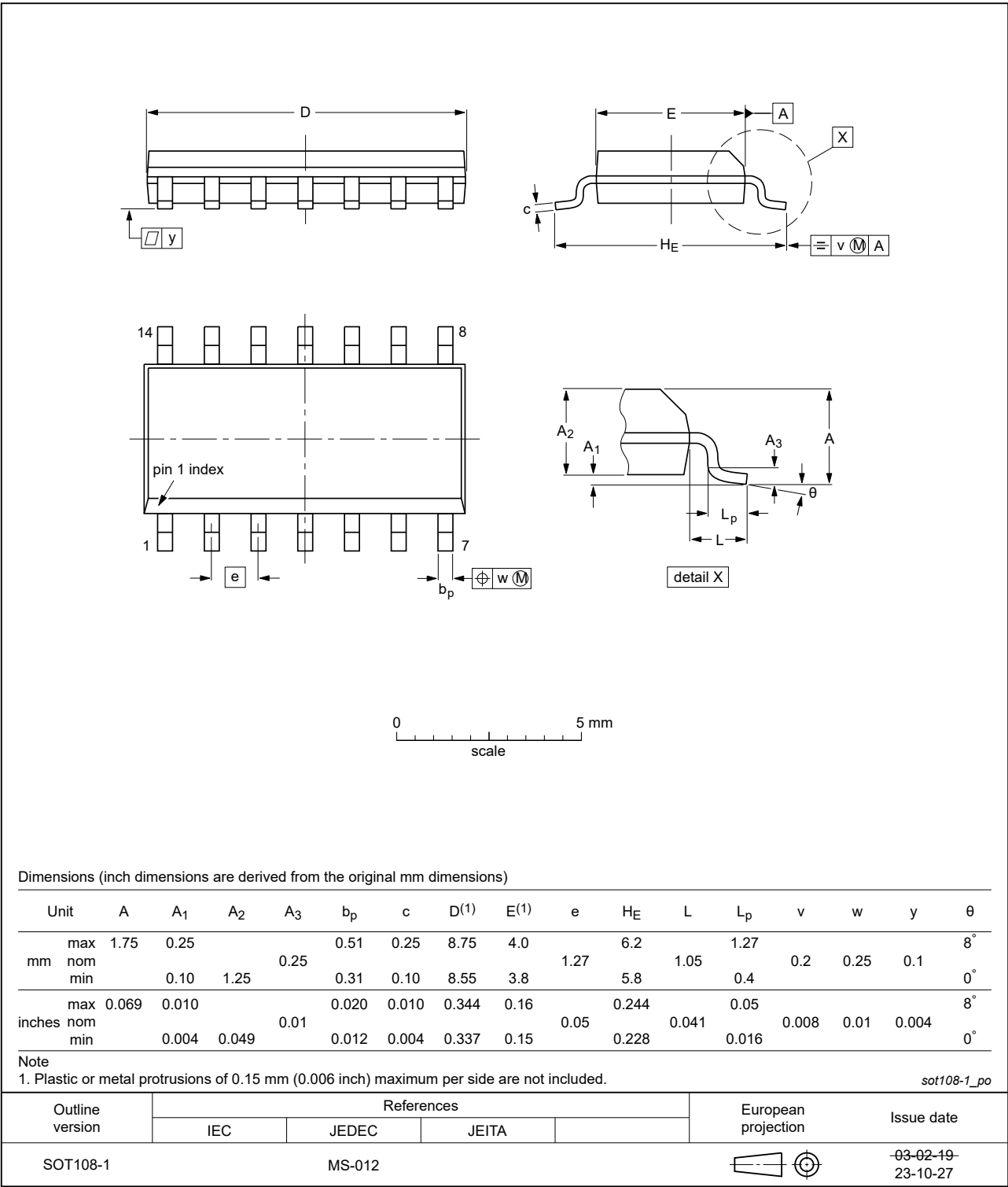


Fig. 12. Package outline SOT108-1 (SO14)

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

SOT402-1

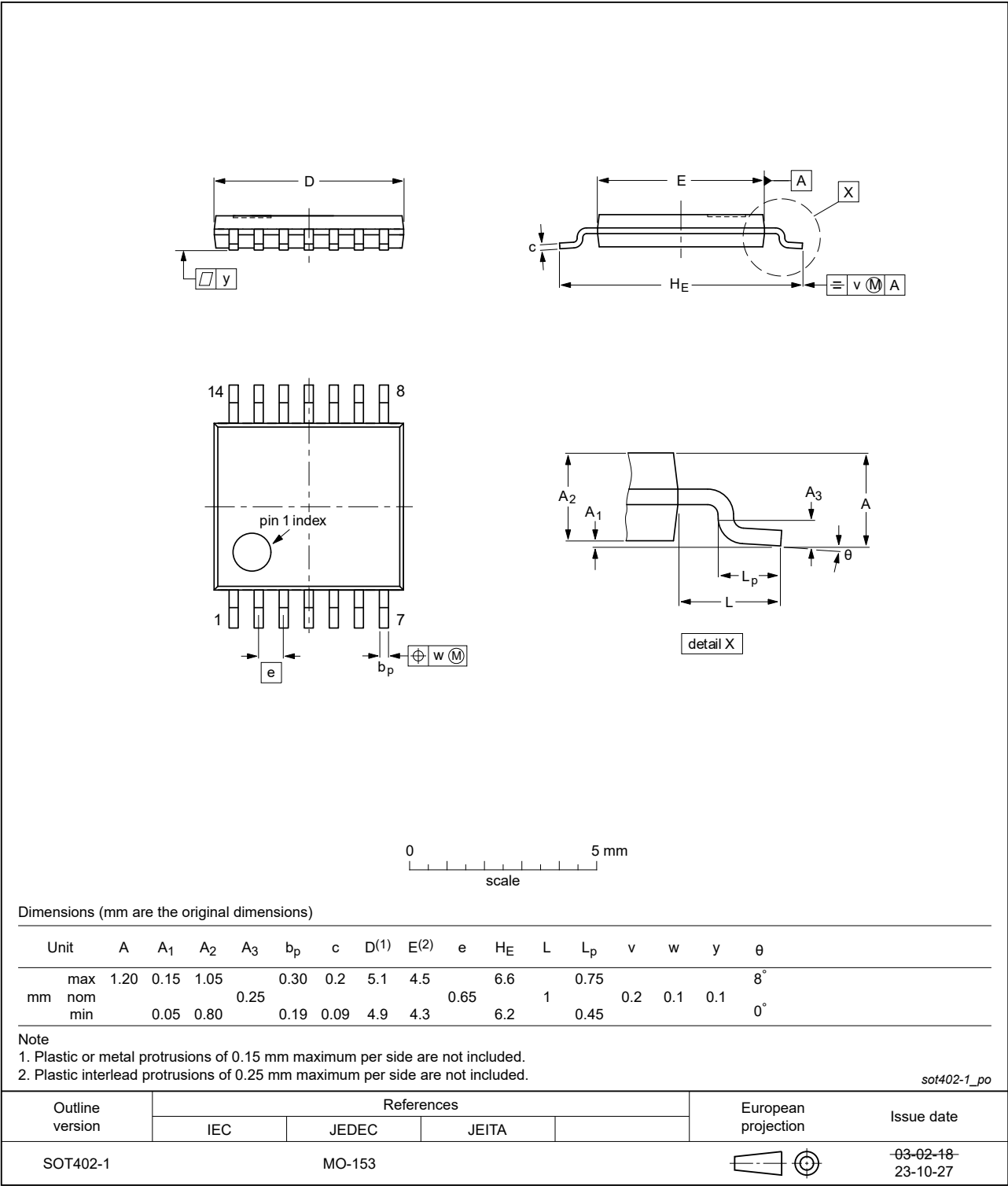
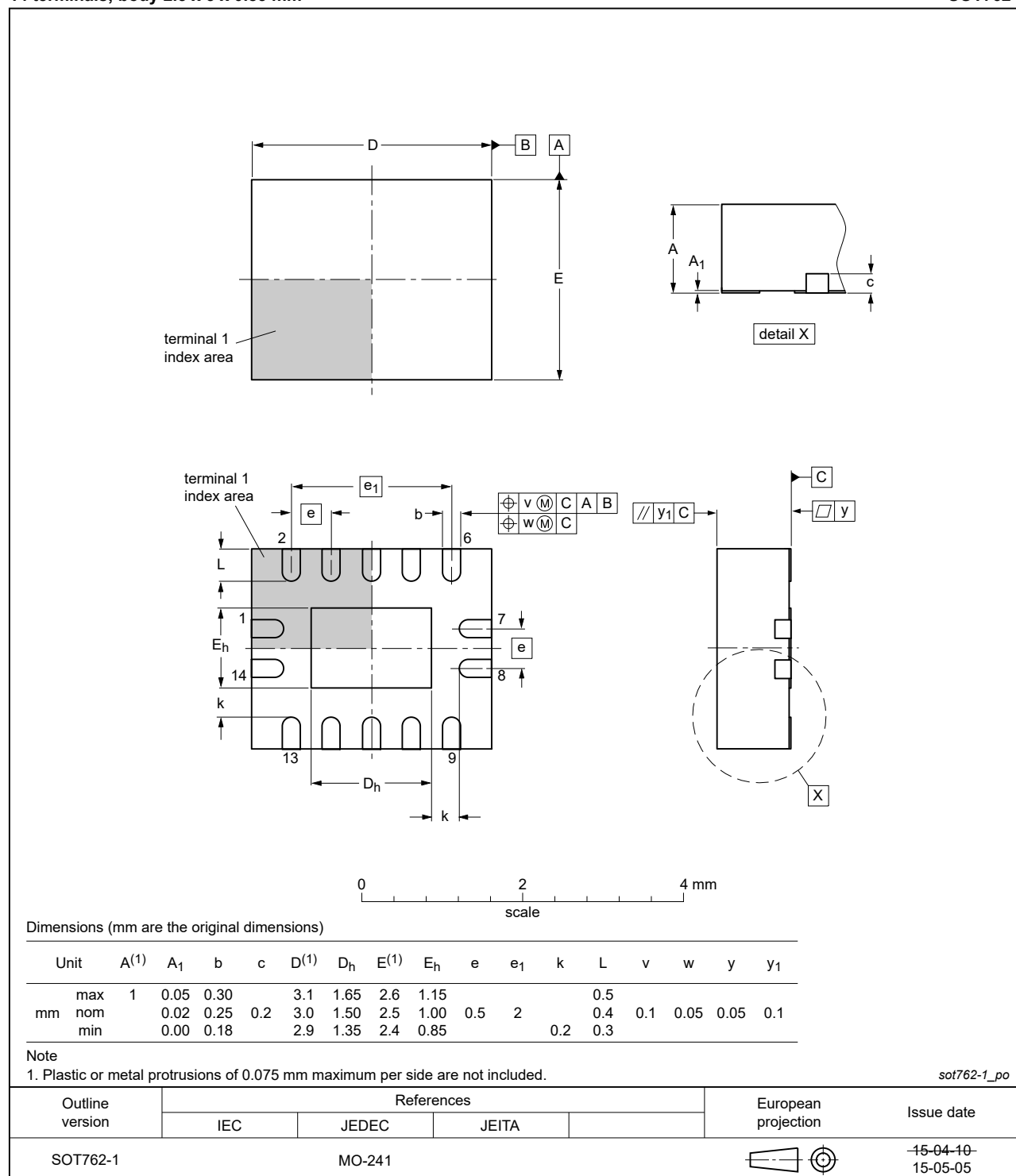


Fig. 13. Package outline SOT402-1 (TSSOP14)

**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. 14. Package outline SOT762-1 (DHVQFN14)**

13. Abbreviations

Table 10. Abbreviations

| Acronym | Description             |
|---------|-------------------------|
| CDM     | Charge Device Model     |
| DUT     | Device Under Test       |
| ESD     | ElectroStatic Discharge |
| HBM     | Human Body Model        |

14. Revision history

Table 11. Revision history

| Document ID      | Release date | Data sheet status  | Change notice | Supersedes |
|------------------|--------------|--------------------|---------------|------------|
| 74HCS04_Q100 v.1 | 20250624     | Product data sheet | -             | -          |

## 15. 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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