

# 74AHCT07A

Hex buffer with open-drain outputs

Rev. 1 — 19 December 2016

Product data sheet

## 1. General description

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The 74AHCT07A is a hex buffer with open-drain outputs. The outputs are open-drain and can be connected to other open-drain outputs to implement active-LOW wired-OR or active-HIGH wired-AND functions.

Designed to operate over a  $V_{CC}$  range from 4.5 V to 5.5 V, the inputs are TTL compatible, which allows the device to be used to translate from 3.3 V to 5 V.

Schmitt-trigger action at all inputs makes the circuit tolerant of slower input rise and fall times.

This device is fully specified for partial Power-down applications using  $I_{OFF}$ . The  $I_{OFF}$  circuitry disables the output, preventing the damaging backflow current through the device when it is powered down.

## 2. Features and benefits

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- Direct interface with TTL levels
- Supply voltage range from 4.5 V to 5.5 V
- Typical  $t_{PZL}$  of 3.4 ns at 5 V
- Typical  $V_{OL(p)} < 0.8$  V at  $V_{CC} = 5$  V,  $T_{amb} = 25$  °C
- Supports mixed-mode voltage operation on all ports
- $I_{OFF}$  circuitry provides partial Power-down mode operation
- Latch-up performance exceeds 250 mA per JESD 78 Class II
- ESD protection:
  - ◆ HBM ANSI/ESDA/JEDEC JS-001 Class 2 exceeds 3 kV
  - ◆ MM JESD22-A115-A exceeds 150 V
  - ◆ CDM JESD22-C101E exceeds 2 kV
- 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  |
| 74AHCT07APW | −40 °C to +125 °C | TSSOP14 | plastic thin shrink small outline package; 14 leads;<br>body width 4.4 mm | SOT402-1 |

4. Functional diagram

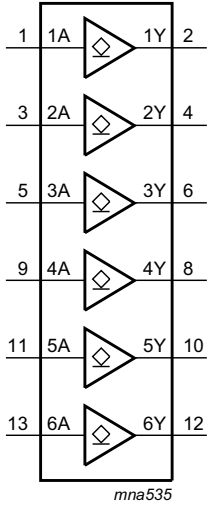


Fig 1. Logic symbol

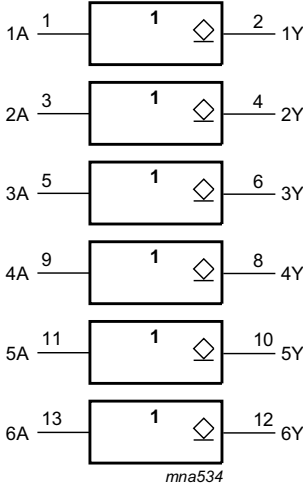


Fig 2. IEC logic symbol

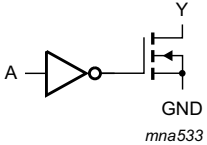


Fig 3. Logic diagram for one gate

5. Pinning information

5.1 Pinning

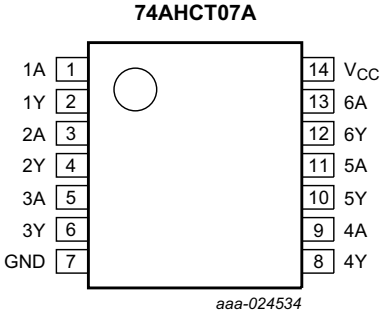


Fig 4. Pin configuration TSSOP14

## 5.2 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 |

## 6. Functional description

Table 3. Function selection [\[1\]](#)

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

[1] H = HIGH voltage level; L = LOW voltage level; Z = high-impedance OFF-state

## 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 | +7.0 | V    |
| V <sub>I</sub>   | input voltage           | <a href="#">[1]</a>                                              | −0.5 | +7.0 | V    |
| V <sub>O</sub>   | output voltage          | output LOW state, power-down or 3-state mode <a href="#">[2]</a> | −0.5 | +7.0 | V    |
| I <sub>IK</sub>  | input clamping current  | V <sub>I</sub> < 0 V                                             | −20  | -    | mA   |
| I <sub>OK</sub>  | output clamping current | V <sub>O</sub> < 0 V                                             | −20  | -    | mA   |
| I <sub>O</sub>   | output current          | V <sub>O</sub> = 0 V to V <sub>CC</sub>                          | -    | ±25  | mA   |
| I <sub>CC</sub>  | supply current          |                                                                  | -    | 75   | mA   |
| I <sub>GND</sub> | ground current          |                                                                  | −75  | -    | mA   |
| T <sub>stg</sub> | storage temperature     |                                                                  | −65  | +150 | °C   |
| P <sub>tot</sub> | total power dissipation | T <sub>amb</sub> = −40 °C to +125 °C <a href="#">[3]</a>         | -    | 500  | mW   |

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

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

[3] For TSSOP14 packages: above 75 °C the value of P<sub>tot</sub> derates linearly at 7 mW/K.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Voltages are referenced to GND (ground = 0 V).

| Symbol           | Parameter                           | Conditions                                   | Min | Typ | Max  | Unit |
|------------------|-------------------------------------|----------------------------------------------|-----|-----|------|------|
| V <sub>CC</sub>  | supply voltage                      |                                              | 4.5 | 5.0 | 5.5  | V    |
| V <sub>I</sub>   | input voltage                       |                                              | 0   | -   | 5.5  | V    |
| V <sub>O</sub>   | output voltage                      | output LOW state, power-down or 3-state mode | 0   | -   | 5.5  | V    |
| T <sub>amb</sub> | ambient temperature                 |                                              | -40 | +25 | +125 | °C   |
| Δt/ΔV            | input transition rise and fall rate | V <sub>CC</sub> = 5.0 V ± 0.5 V              | -   | -   | 20   | ns/V |

## 9. Static characteristics

**Table 6. Static characteristics**

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>IH</sub>  | HIGH-level input voltage  | V <sub>CC</sub> = 4.5 V to 5.5 V                                                                                           | 2     | -   | -     | 2                | -    | 2                 | -    | V    |
| V <sub>IL</sub>  | LOW-level input voltage   | V <sub>CC</sub> = 4.5 V to 5.5 V                                                                                           | -     | -   | 0.8   | -                | 0.8  | -                 | 0.8  | 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> = 50 μA                                                                                                     | -     | 0   | 0.1   | -                | 0.1  | -                 | 0.1  | V    |
|                  |                           | I <sub>O</sub> = 8 mA                                                                                                      | -     | -   | 0.36  | -                | 0.44 | -                 | 0.55 | V    |
| I <sub>OZ</sub>  | OFF-state output current  | V <sub>CC</sub> = 5.5 V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = GND to 5.5 V               | -     | -   | ±0.25 | -                | ±2.5 | -                 | ±2.5 | μA   |
| I <sub>OFF</sub> | power-off leakage current | V <sub>I</sub> or V <sub>O</sub> = GND to 5.5 V; V <sub>CC</sub> = 0 V                                                     | -     | -   | 0.5   | -                | 5    | -                 | 5    | μA   |
| I <sub>I</sub>   | input leakage current     | V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 0 V to 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     | -                | 20   | -                 | 20   | μA   |
| ΔI <sub>CC</sub> | additional supply current | per input pin; V <sub>I</sub> = 3.4 V; I <sub>O</sub> = 0 A; other pins at V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V | -     | -   | 1.35  | -                | 1.5  | -                 | 1.5  | mA   |

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

$GND = 0\text{ V}$ . For test circuit see [Figure 6](#).

| Symbol    | Parameter                          | Conditions                                                                                            | 25 °C |                    |     | –40 °C to +85 °C |     | –40 °C to +125 °C |      | Unit |
|-----------|------------------------------------|-------------------------------------------------------------------------------------------------------|-------|--------------------|-----|------------------|-----|-------------------|------|------|
|           |                                    |                                                                                                       | Min   | Typ <sup>[1]</sup> | Max | Min              | Max | Min               | Max  |      |
| $t_{PZL}$ | OFF-state to LOW propagation delay | nA to nY; see <a href="#">Figure 5</a>                                                                |       |                    |     |                  |     |                   |      |      |
|           |                                    | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$                                                               |       |                    |     |                  |     |                   |      |      |
|           |                                    | $C_L = 15\text{ pF}$                                                                                  | -     | 3.4                | 5.3 | 1                | 6.5 | 1                 | 7.6  | ns   |
|           |                                    | $C_L = 50\text{ pF}$                                                                                  | -     | 5                  | 7.8 | 1                | 9.7 | 1                 | 11.4 | ns   |
| $t_{PLZ}$ | LOW to OFF-state propagation delay | nA to nY; see <a href="#">Figure 5</a>                                                                |       |                    |     |                  |     |                   |      |      |
|           |                                    | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$                                                               |       |                    |     |                  |     |                   |      |      |
|           |                                    | $C_L = 15\text{ pF}$                                                                                  | -     | 2.9                | 4   | 1                | 4.6 | 1                 | 5.2  | ns   |
|           |                                    | $C_L = 50\text{ pF}$                                                                                  | -     | 5.2                | 6.7 | 1                | 7.6 | 1                 | 8.5  | ns   |
| $C_I$     | input capacitance                  | $V_I = V_{CC}\text{ or GND};$<br>$V_{CC} = 5\text{ V}$                                                | -     | 2                  | 6   | -                | 6   | -                 | 6    | pF   |
| $C_O$     | output capacitance                 | $V_O = V_{CC}\text{ or GND};$<br>$V_{CC} = 5\text{ V}$                                                | -     | 5                  | -   | -                | -   | -                 | -    | pF   |
| $C_{PD}$  | power dissipation capacitance      | per buffer; <sup>[2]</sup><br>$C_L = 0\text{ pF}; f = 10\text{ MHz};$<br>$V_I = GND\text{ to }V_{CC}$ | -     | 2                  | -   | -                | -   | -                 | -    | pF   |

[1] Typical values are measured at  $T_{amb} = 25\text{ °C}$  and  $V_{CC} = 5\text{ V}$ .

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

$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$  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 Volts.

Table 8. Noise characteristics  
GND = 0 V. For test circuit see [Figure 6](#).

| Symbol                                        | Parameter                             | Conditions | T <sub>amb</sub> = 25 °C |      |     | Unit |
|-----------------------------------------------|---------------------------------------|------------|--------------------------|------|-----|------|
|                                               |                                       |            | Min                      | Typ  | Max |      |
| V <sub>CC</sub> = 5 V; C <sub>L</sub> = 50 pF |                                       |            |                          |      |     |      |
| V <sub>OL(p)</sub>                            | LOW-level output voltage (peak)       |            | -                        | 0.4  | 0.8 | V    |
| V <sub>OL(v)</sub>                            | LOW-level output voltage (valley)     |            | −0.8                     | −0.2 | -   | V    |
| V <sub>IH(AC)</sub>                           | AC HIGH-level input voltage (dynamic) |            | 2                        | -    | -   | V    |
| V <sub>IL(AC)</sub>                           | AC LOW-level input voltage (dynamic)  |            | -                        | -    | 0.8 | V    |

11. Waveforms

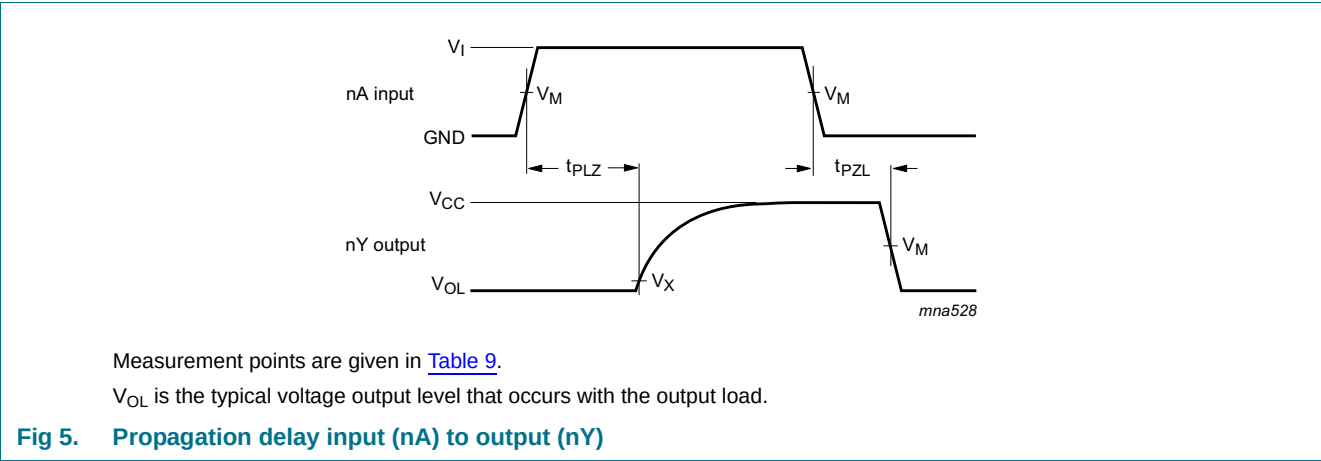


Table 9. Measurement points

| Input          | Output                |                         |
|----------------|-----------------------|-------------------------|
| V <sub>M</sub> | V <sub>M</sub>        | V <sub>X</sub>          |
| 1.5 V          | 0.5 × V <sub>CC</sub> | V <sub>OL</sub> + 0.3 V |

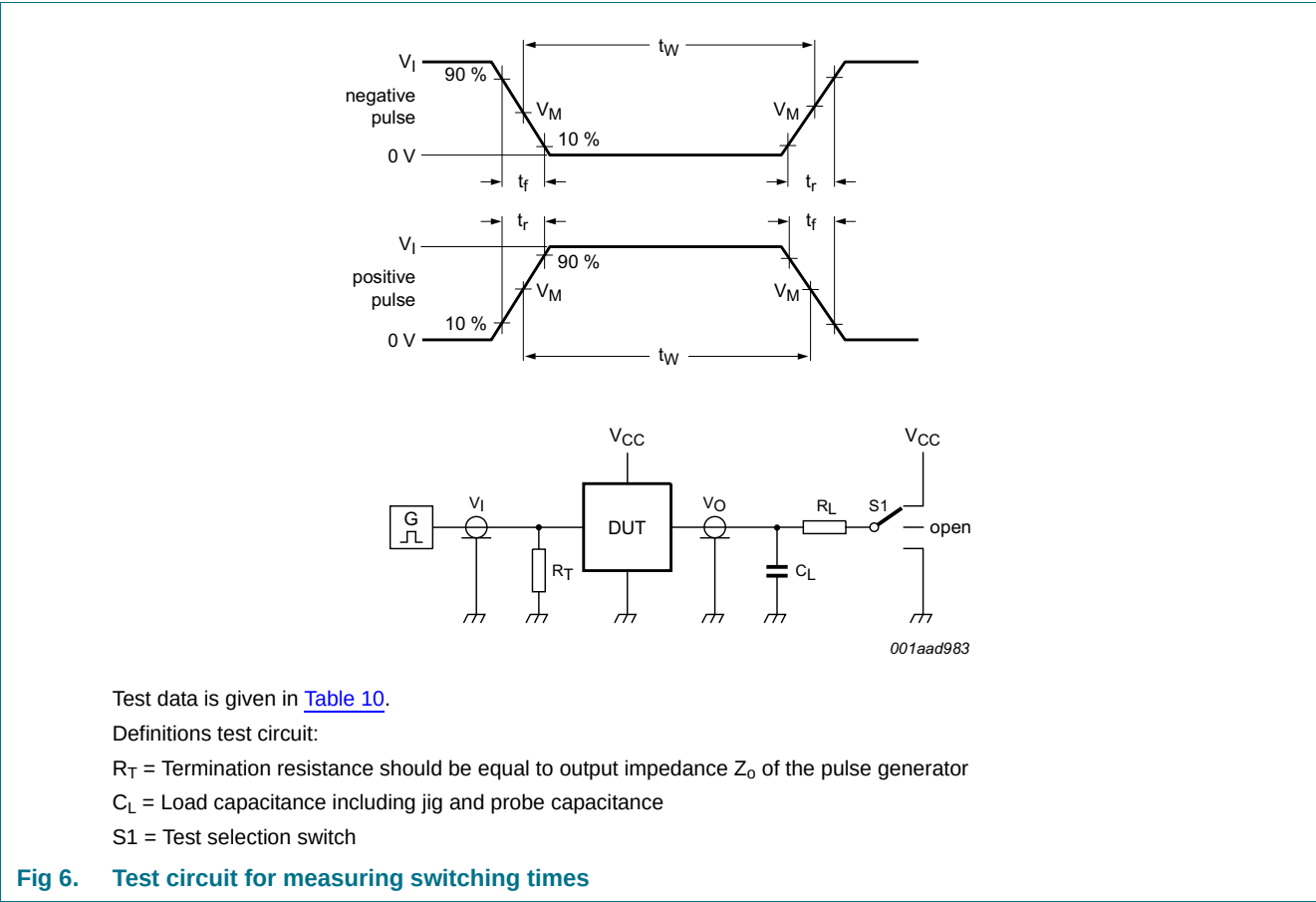


Table 10. Test data

| Input        |            | Load         | S1 position        |
|--------------|------------|--------------|--------------------|
| $V_I$        | $t_r, t_f$ | $C_L$        | $t_{PLZ}, t_{PZL}$ |
| GND to 3.0 V | 3.0 ns     | 15 pF, 50 pF | $V_{CC}$           |

12. Package outline

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

SOT402-1

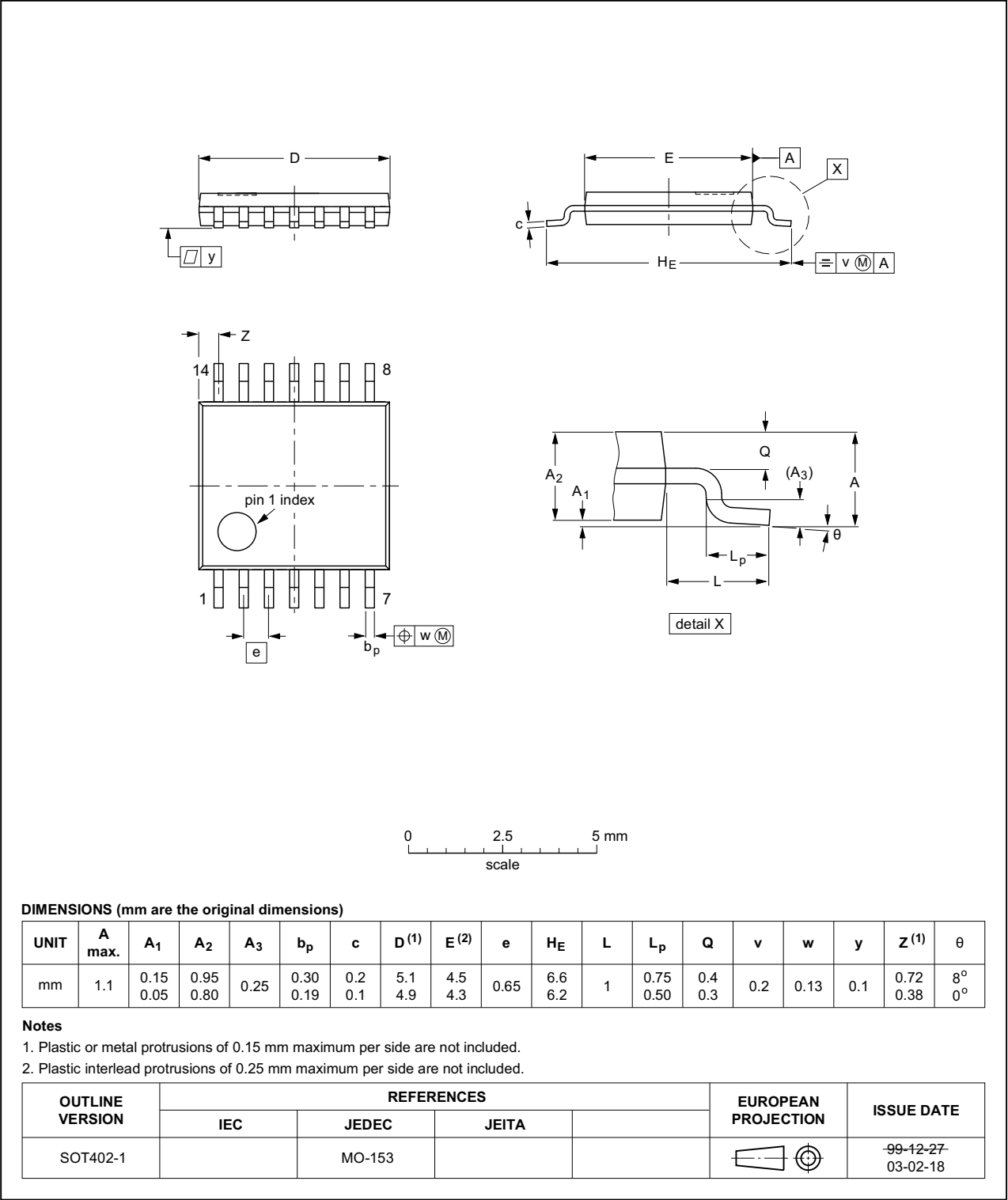


Fig 7. Package outline SOT402-1 (TSSOP14)

## 13. Abbreviations

Table 11. Abbreviations

| Acronym | Description                 |
|---------|-----------------------------|
| CDM     | Charge Device Model         |
| DUT     | Device Under Test           |
| ESD     | ElectroStatic Discharge     |
| HBM     | Human Body Model            |
| MM      | Machine Model               |
| TTL     | Transistor-Transistor Logic |

## 14. Revision history

Table 12. Revision history

| Document ID   | Release date | Data sheet status  | Change notice | Supersedes |
|---------------|--------------|--------------------|---------------|------------|
| 74AHCT07A v.1 | 20161219     | Product data sheet | -             | -          |

## 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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