

74AHC132-Q100; 74AHCT132-Q100

Quad 2-input NAND Schmitt trigger

Rev. 2 — 3 July 2020

Product data sheet

1. General description

The 74AHC132-Q100; 74AHCT132-Q100 is a quad 2-input NAND gate with Schmitt-trigger inputs. Inputs are overvoltage tolerant. This feature allows the use of these devices as translators in mixed voltage environments.

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

- 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 5.5 V
- Overvoltage tolerant inputs to 5.5 V
- High noise immunity
- CMOS low power dissipation
- Input levels:
 - For 74AHC132-Q100: CMOS level
 - For 74AHCT132-Q100: TTL level
- ESD protection:
 - MIL-STD-883, method 3015 exceeds 2000 V
 - HBM JESD22-A114F exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V (C = 200 pF, R = 0 Ω)
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level A
- Multiple package options
- DHVQFN package with Side-Wettable Flanks enabling Automatic Optical Inspection (AOI) of solder joints

3. Ordering information

Table 1. Ordering information

| Type number | Package | | | Version |
|------------------|-------------------|----------|--|----------|
| | Temperature range | Name | Description | |
| 74AHC132D-Q100 | -40 °C to +125 °C | SO14 | plastic small outline package; 14 leads; body width 3.9 mm | SOT108-1 |
| 74AHCT132D-Q100 | | | | |
| 74AHC132PW-Q100 | -40 °C to +125 °C | TSSOP14 | plastic thin shrink small outline package; 14 leads; body width 4.4 mm | SOT402-1 |
| 74AHCT132PW-Q100 | | | | |
| 74AHC132BQ-Q100 | -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 | SOT762-1 |
| 74AHCT132BQ-Q100 | | | | |

4. Functional diagram

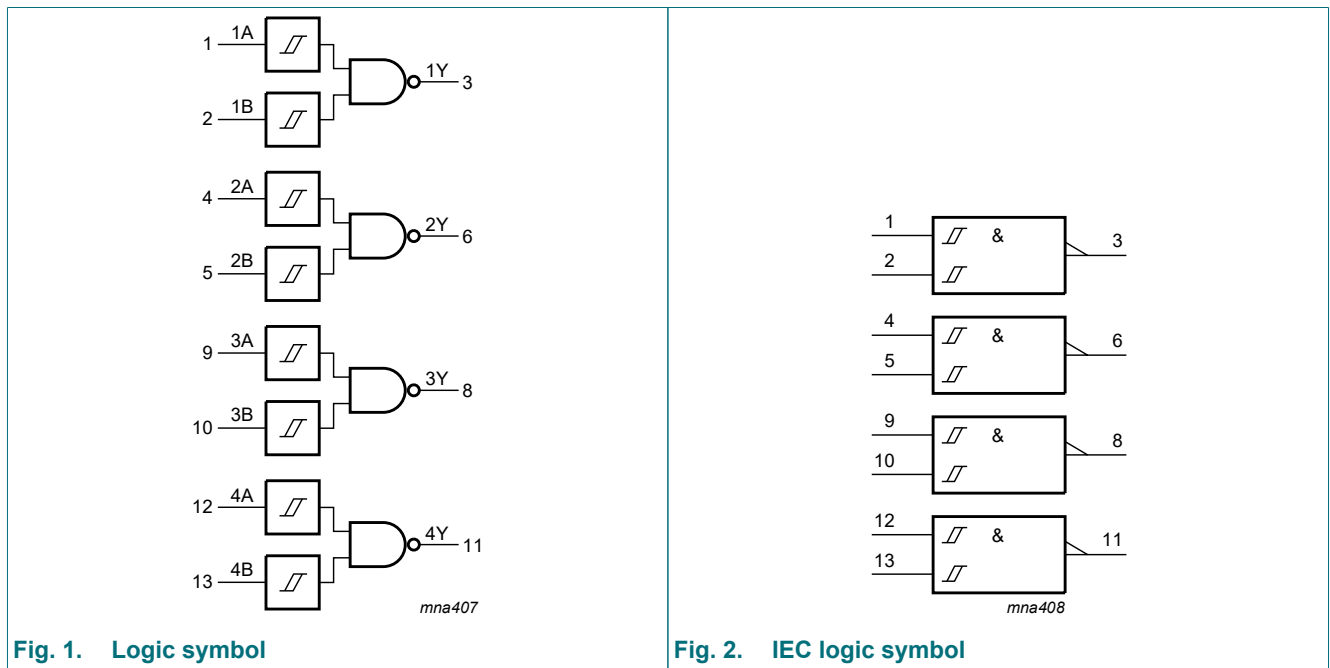


Fig. 1. Logic symbol

Fig. 2. IEC logic symbol

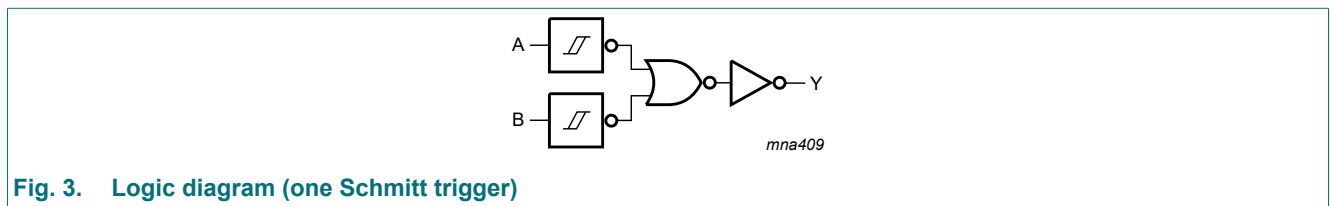
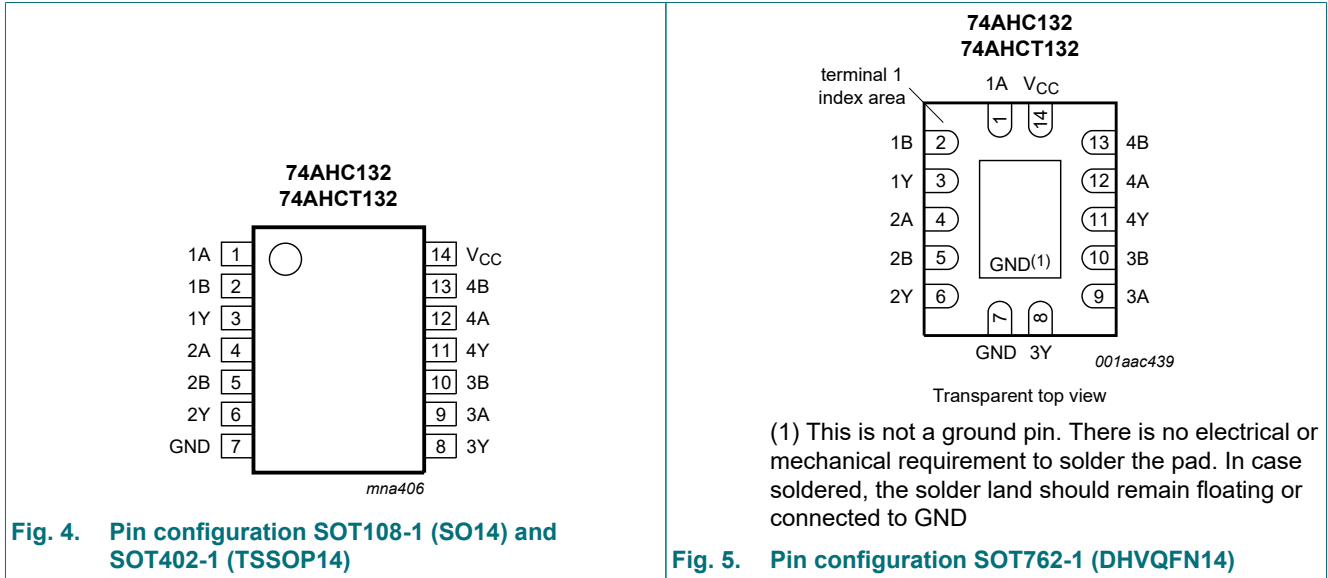


Fig. 3. Logic diagram (one Schmitt trigger)

5. Pinning information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

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

6. Functional description

Table 3. Function table

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

| Input | | Output |
|-------|----|--------|
| nA | nB | nY |
| L | L | H |
| L | H | H |
| H | L | 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 | +7.0 | V |
| V_I | input voltage | | -0.5 | +7.0 | V |
| I_{IK} | input clamping current | $V_I < -0.5$ V [1] | -20 | - | mA |
| I_{OK} | output clamping current | $V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V [1] | -20 | +20 | mA |
| I_O | output current | $V_O = -0.5$ V to $(V_{CC} + 0.5$ V) | -25 | +25 | mA |
| I_{CC} | supply current | | - | +75 | mA |
| I_{GND} | ground current | | -75 | - | mA |
| T_{stg} | storage temperature | | -65 | +150 | °C |
| P_{tot} | total power dissipation | $T_{amb} = -40$ °C to +125 °C [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.

For SOT762-1 (DHVQFN14) package: P_{tot} derates linearly with 9.6 mW/K above 98 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions

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

| Symbol | Parameter | Conditions | 74AHC132-Q100 | | | 74AHCT132-Q100 | | | Unit |
|---------------------|-------------------------------------|------------------------------|---------------|-----|----------|----------------|-----|----------|------|
| | | | Min | Typ | Max | Min | Typ | Max | |
| V_{CC} | supply voltage | | 2.0 | 5.0 | 5.5 | 4.5 | 5.0 | 5.5 | V |
| V_I | input voltage | | 0 | - | 5.5 | 0 | - | 5.5 | V |
| V_O | output voltage | | 0 | - | V_{CC} | 0 | - | V_{CC} | V |
| T_{amb} | ambient temperature | | -40 | +25 | +125 | -40 | +25 | +125 | °C |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 3.3$ V \pm 0.3 V | - | - | 100 | - | - | - | ns/V |
| | | $V_{CC} = 5.0$ V \pm 0.5 V | - | - | 20 | - | - | 20 | 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 | |
| 74AHC132-Q100 | | | | | | | | | | |
| V _{OH} | HIGH-level output voltage | V _I = V _{T+} or V _{T-} | | | | | | | | |
| | | I _O = -50 µA; V _{CC} = 2.0 V | 1.9 | 2.0 | - | 1.9 | 2.2 | 1.9 | - | V |
| | | I _O = -50 µA; V _{CC} = 3.0 V | 2.9 | 3.0 | - | 2.9 | 3.15 | 2.9 | - | V |
| | | I _O = -50 µA; V _{CC} = 4.5 V | 4.4 | 4.5 | - | 4.4 | 3.85 | 4.4 | - | V |
| | | I _O = -4.0 mA; V _{CC} = 3.0 V | 2.58 | - | - | 2.48 | - | 2.40 | - | V |
| | | I _O = -8.0 mA; V _{CC} = 4.5 V | 3.94 | - | - | 3.80 | - | 3.70 | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{T+} or V _{T-} | | | | | | | | |
| | | I _O = 50 µA; V _{CC} = 2.0 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 50 µA; V _{CC} = 3.0 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 50 µA; V _{CC} = 4.5 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 4.0 mA; V _{CC} = 3.0 V | - | - | 0.36 | - | 0.44 | - | 0.55 | V |
| | | I _O = 8.0 mA; V _{CC} = 4.5 V | - | - | 0.36 | - | 0.44 | - | 0.55 | V |
| I _I | input leakage current | V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V | - | - | 0.1 | - | 1.0 | - | 2.0 | µA |
| I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V | - | - | 2.0 | - | 20 | - | 40 | µA |
| C _I | input capacitance | V _I = V _{CC} or GND | - | 3 | 10 | - | 10 | - | 10 | pF |
| C _O | output capacitance | | - | 4 | - | - | - | - | - | pF |
| 74AHCT132-Q100 | | | | | | | | | | |
| V _{OH} | HIGH-level output voltage | V _I = V _{T+} or V _{T-} ; V _{CC} = 4.5 V | | | | | | | | |
| | | I _O = -50 µA | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | I _O = -8.0 mA | 3.94 | - | - | 3.80 | - | 3.70 | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{T+} or V _{T-} ; V _{CC} = 4.5 V | | | | | | | | |
| | | I _O = 50 µA | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 8.0 mA | - | - | 0.36 | - | 0.44 | - | 0.55 | V |
| I _I | input leakage current | V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V | - | - | 0.1 | - | 1.0 | - | 2.0 | µA |
| I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V | - | - | 2.0 | - | 20 | - | 40 | µA |
| ΔI _{CC} | additional supply current | per input pin; V _I = V _{CC} - 2.1 V; other pins at V _{CC} or GND; I _O = 0 A; V _{CC} = 4.5 V to 5.5 V | - | - | 1.35 | - | 1.5 | - | 1.5 | mA |
| C _I | input capacitance | V _I = V _{CC} or GND | - | 3 | 10 | - | 10 | - | 10 | pF |
| C _O | output capacitance | | - | 4 | - | - | - | - | - | pF |

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 7.

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|---|-------------------------------|--|-------|--------|------|------------------|------|-------------------|------|------|
| | | | Min | Typ[1] | Max | Min | Max | Min | Max | |
| 74AHC132-Q100 | | | | | | | | | | |
| t_{pd} | propagation delay | nA, nB to nY; see Fig. 6 [2] | | | | | | | | |
| | | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$ | | | | | | | | |
| | | $C_L = 15\text{ pF}$ | - | 4.4 | 11.9 | 1.0 | 14.0 | 1.0 | 15.0 | ns |
| | | $C_L = 50\text{ pF}$ | - | 6.2 | 15.4 | 1.0 | 17.5 | 1.0 | 19.5 | ns |
| | | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ | | | | | | | | |
| | | $C_L = 15\text{ pF}$ | - | 3.3 | 7.7 | 1.0 | 9.0 | 1.0 | 10.0 | ns |
| | | $C_L = 50\text{ pF}$ | - | 4.7 | 9.7 | 1.0 | 11.0 | 1.0 | 12.5 | ns |
| C_{PD} | power dissipation capacitance | $f_i = 1\text{ MHz}; V_i = \text{GND to }V_{CC}$ [3] | - | 11 | - | - | - | - | - | pF |
| 74AHCT132-Q100; $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ | | | | | | | | | | |
| t_{pd} | propagation delay | nA, nB to nY; see Fig. 6 [2] | | | | | | | | |
| | | $C_L = 15\text{ pF}$ | - | 3.5 | 7.0 | 1.0 | 8.0 | 1.0 | 9.0 | ns |
| | | $C_L = 50\text{ pF}$ | - | 5.0 | 8.0 | 1.0 | 9.0 | 1.0 | 10.0 | ns |
| C_{PD} | power dissipation capacitance | $f_i = 1\text{ MHz}; V_i = \text{GND to }V_{CC}$ [3] | - | 14 | - | - | - | - | - | pF |

[1] Typical values are measured at nominal supply voltage ($V_{CC} = 3.3\text{ V}$ and $V_{CC} = 5.0\text{ V}$).

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

[3] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

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

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 the outputs.

10.1. Waveform and test circuit

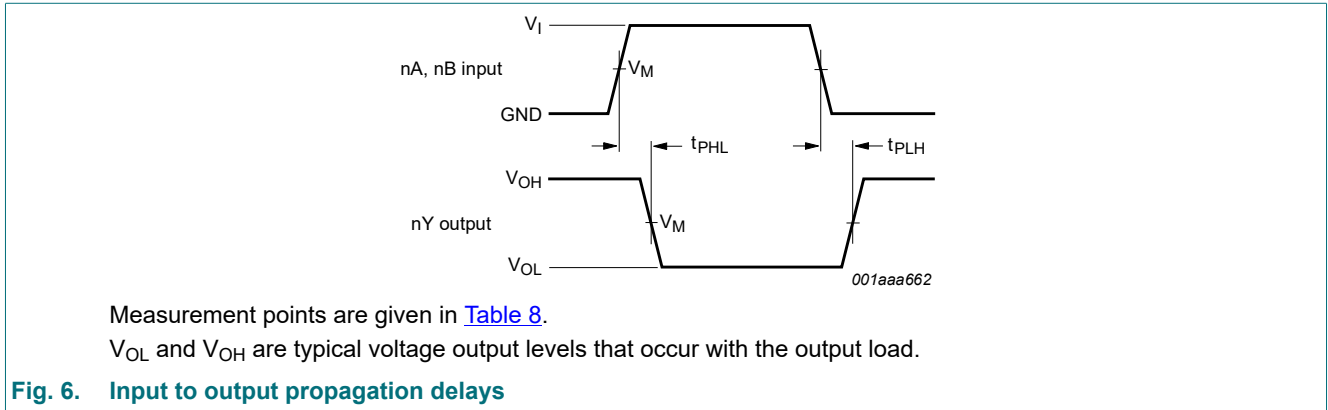


Table 8. Measurement points

| Type | Input | | Output |
|----------------|---------------------|--|---------------------|
| | V_M | | V_M |
| 74AHC132-Q100 | $0.5 \times V_{CC}$ | | $0.5 \times V_{CC}$ |
| 74AHCT132-Q100 | 1.5 V | | $0.5 \times V_{CC}$ |

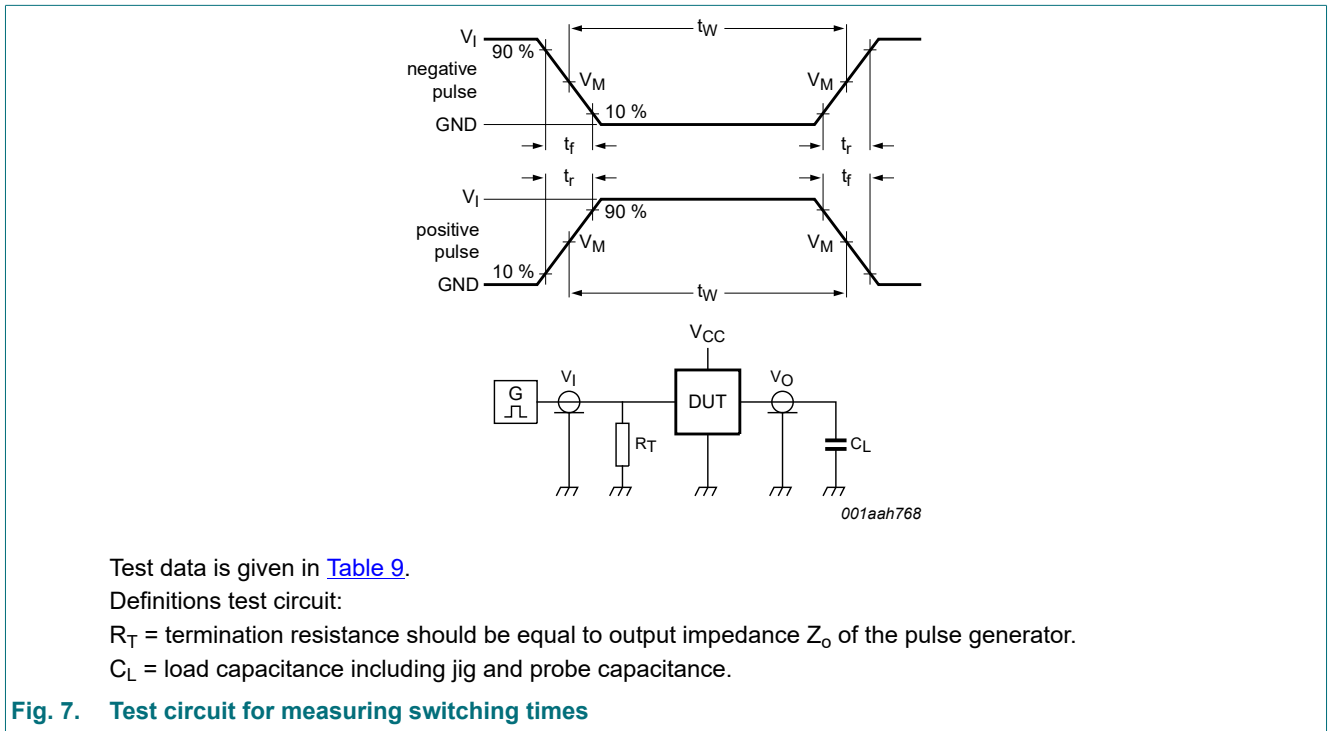


Table 9. Test data

| Type | Input | | Load | Test |
|----------------|----------|---------------|--------------|--------------------|
| | V_I | t_r, t_f | C_L | |
| 74AHC132-Q100 | V_{CC} | ≤ 3.0 ns | 50 pF, 15 pF | t_{PLH}, t_{PHL} |
| 74AHCT132-Q100 | 3.0 V | ≤ 3.0 ns | 50 pF, 15 pF | t_{PLH}, t_{PHL} |

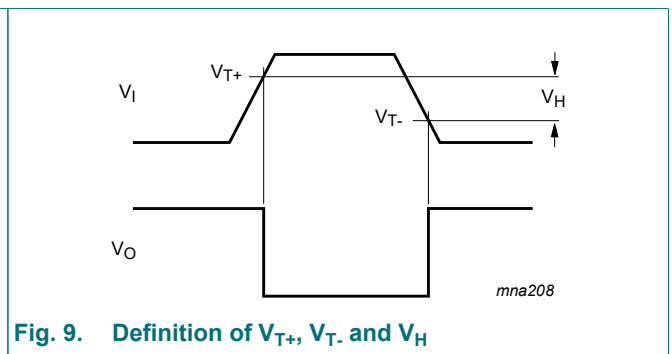
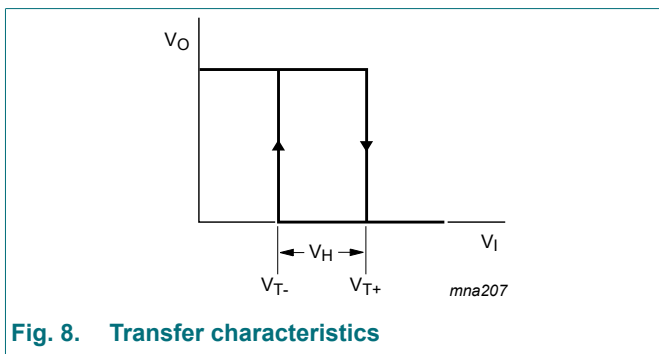
11. Transfer characteristics

Table 10. Transfer 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 | |
| 74AHC132-Q100 | | | | | | | | | | |
| V_{T+} | positive-going threshold voltage | $V_{CC} = 3.0\text{ V}$ | - | - | 2.2 | - | 2.2 | - | 2.2 | V |
| | | $V_{CC} = 4.5\text{ V}$ | - | - | 3.15 | - | 3.15 | - | 3.15 | V |
| | | $V_{CC} = 5.5\text{ V}$ | - | - | 3.85 | - | 3.85 | - | 3.85 | V |
| V_{T-} | negative-going threshold voltage | $V_{CC} = 3.0\text{ V}$ | 0.9 | - | - | 0.9 | - | 0.9 | - | V |
| | | $V_{CC} = 4.5\text{ V}$ | 1.35 | - | - | 1.35 | - | 1.35 | - | V |
| | | $V_{CC} = 5.5\text{ V}$ | 1.65 | - | - | 1.65 | - | 1.65 | - | V |
| V_H | hysteresis voltage | $V_{CC} = 3.0\text{ V}$ | 0.3 | - | 1.2 | 0.3 | 1.2 | 0.25 | 1.2 | V |
| | | $V_{CC} = 4.5\text{ V}$ | 0.4 | - | 1.4 | 0.4 | 1.4 | 0.35 | 1.4 | V |
| | | $V_{CC} = 5.5\text{ V}$ | 0.5 | - | 1.6 | 0.5 | 1.6 | 0.45 | 1.6 | V |
| 74AHCT132-Q100 | | | | | | | | | | |
| V_{T+} | positive-going threshold voltage | $V_{CC} = 4.5\text{ V}$ | - | - | 1.9 | - | 1.9 | - | 1.9 | V |
| | | $V_{CC} = 5.5\text{ V}$ | - | - | 2.1 | - | 2.1 | - | 2.1 | V |
| V_{T-} | negative-going threshold voltage | $V_{CC} = 4.5\text{ V}$ | 0.5 | - | - | 0.5 | - | 0.5 | - | V |
| | | $V_{CC} = 5.5\text{ V}$ | 0.6 | - | - | 0.6 | - | 0.6 | - | V |
| V_H | hysteresis voltage | $V_{CC} = 4.5\text{ V}$ | 0.3 | - | 1.4 | 0.3 | 1.4 | 0.3 | 1.4 | V |
| | | $V_{CC} = 5.5\text{ V}$ | 0.3 | - | 1.5 | 0.3 | 1.5 | 0.3 | 1.5 | V |

11.1. Transfer characteristics waveforms



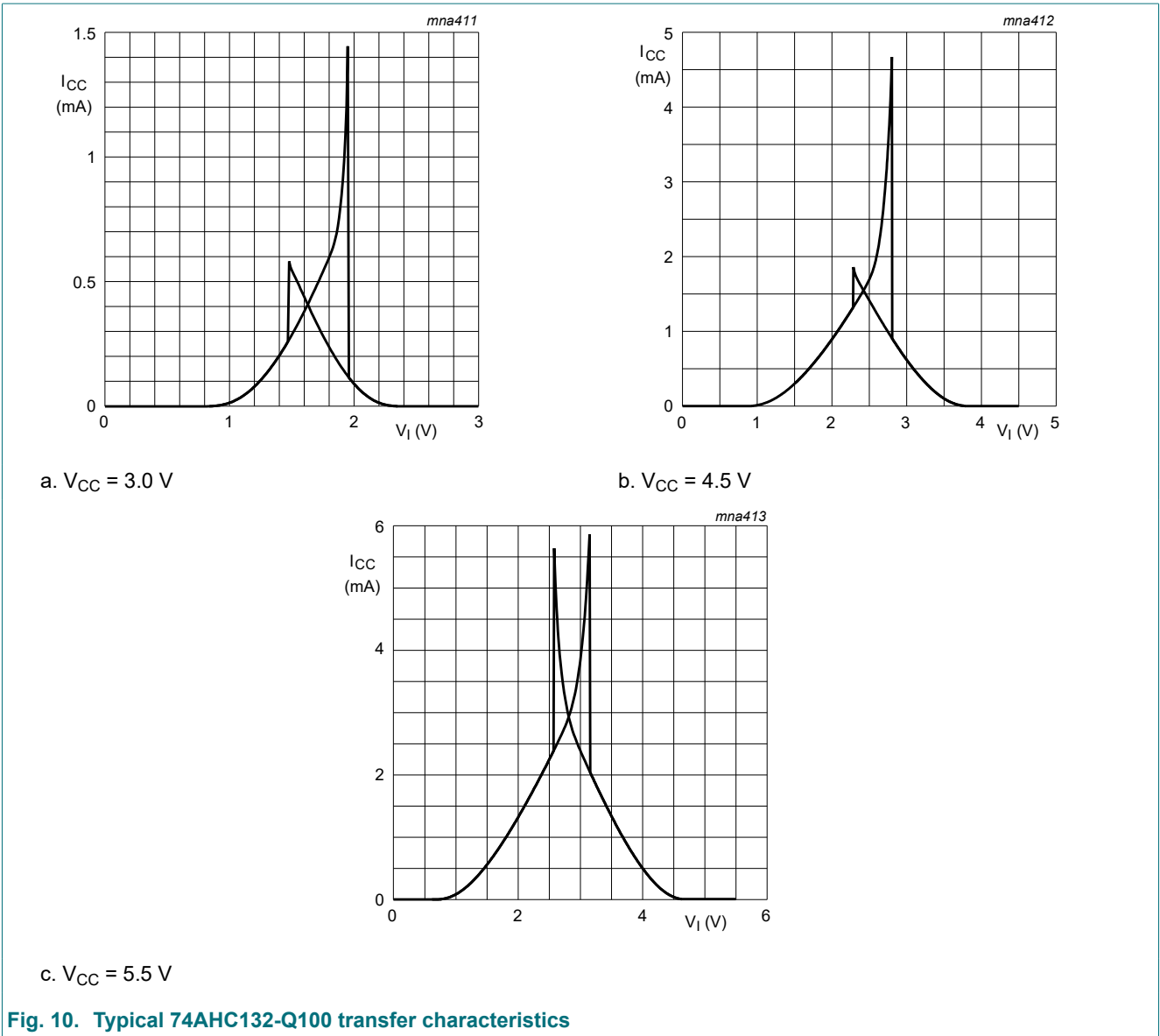


Fig. 10. Typical 74AHC132-Q100 transfer characteristics

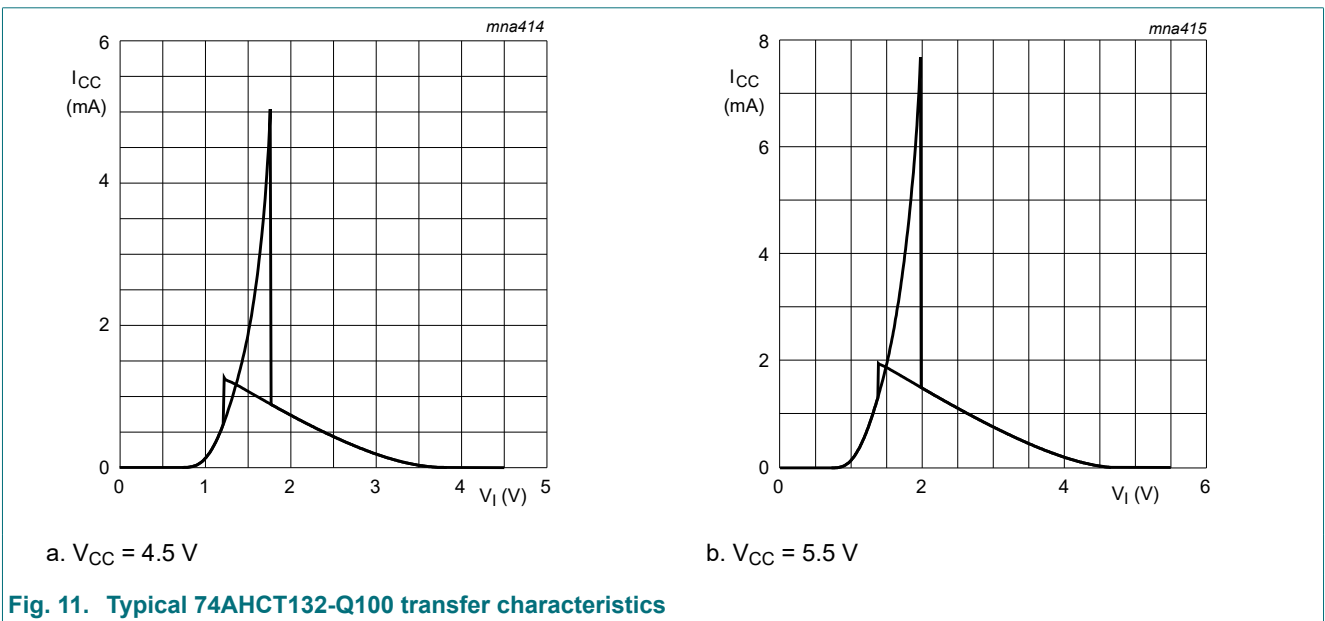
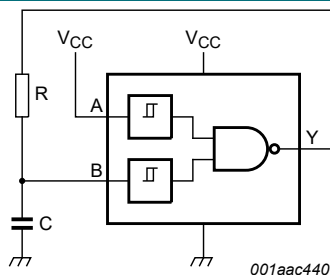


Fig. 11. Typical 74AHCT132-Q100 transfer characteristics

12. Application information



$$\text{For 74AHC132-Q100: } f = \frac{1}{T} \approx \frac{1}{0.55 \times RC}$$
$$\text{For 74AHCT132-Q100: } f = \frac{1}{T} \approx \frac{1}{0.60 \times RC}$$

Fig. 12. Relaxation oscillator

13. Package outline

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

SOT108-1

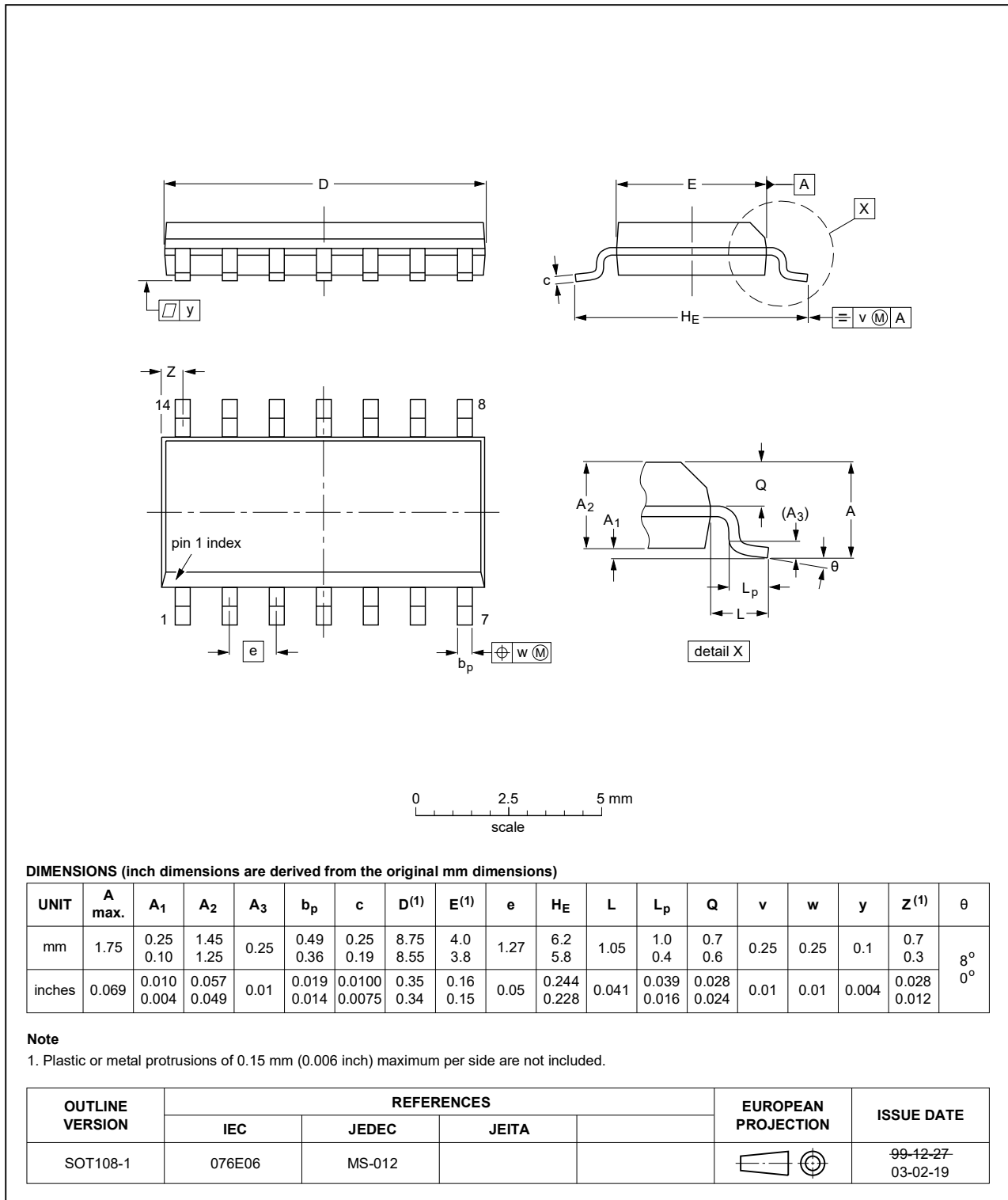


Fig. 13. Package outline SOT108-1 (SO14)

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

SOT402-1

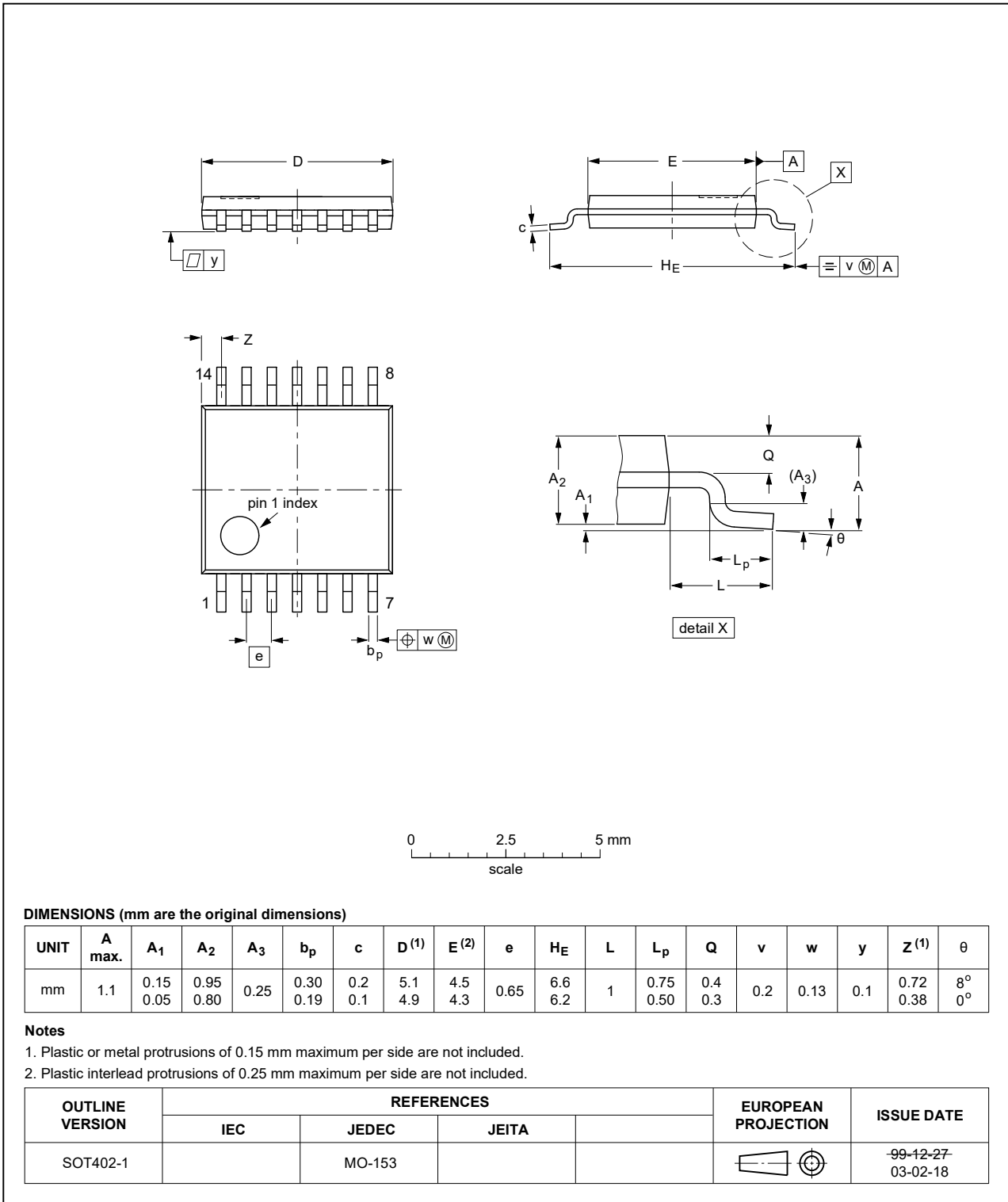


Fig. 14. Package outline SOT402-1 (TSSOP14)

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

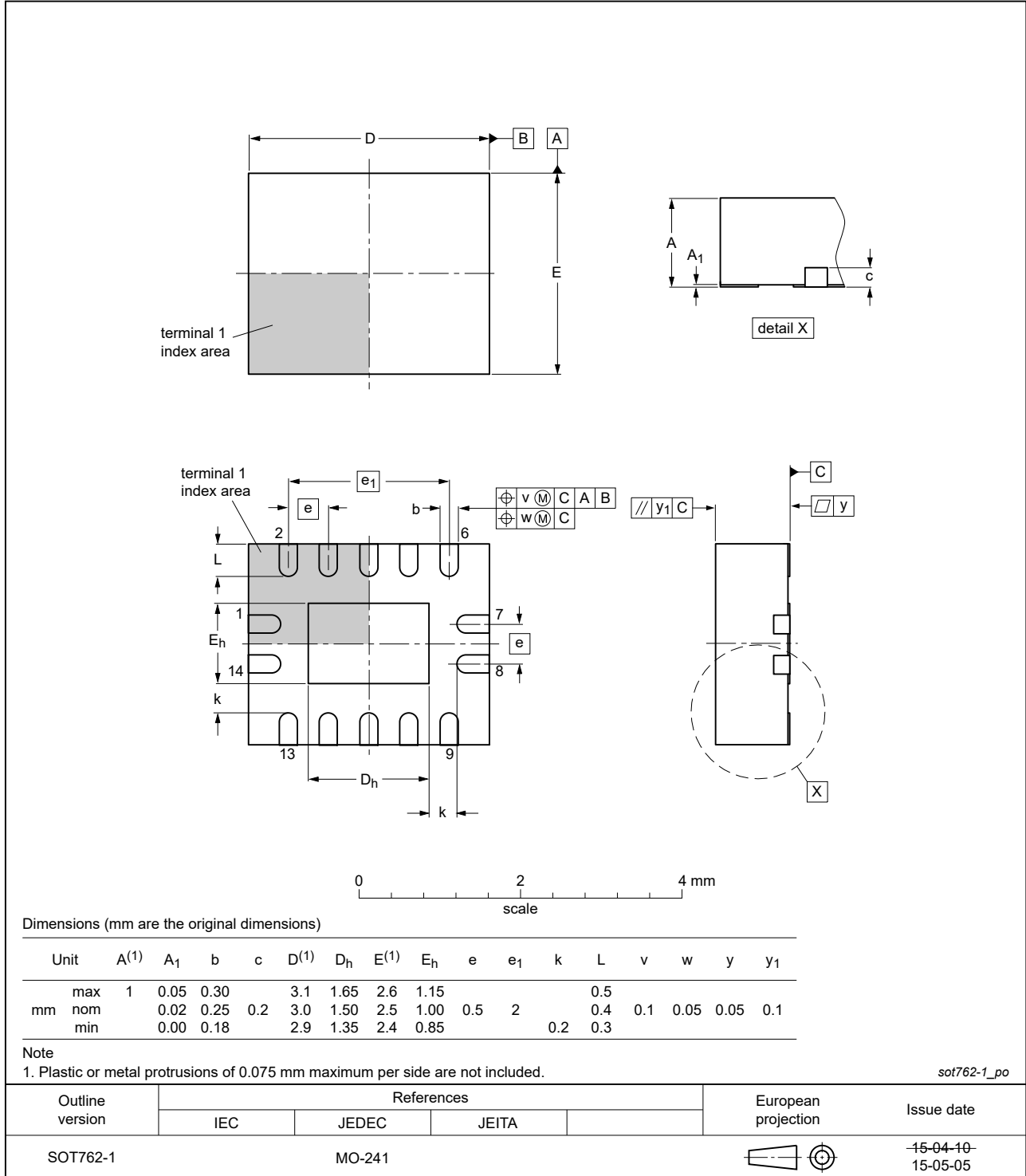


Fig. 15. Package outline SOT762-1 (DHVQFN14)

14. Abbreviations

Table 11. Abbreviations

| Acronym | Description |
|---------|---|
| CMOS | Complementary Metal-Oxide Semiconductor |
| DUT | Device Under Test |
| ESD | ElectroStatic Discharge |
| HBM | Human Body Model |
| MIL | Military |
| MM | Machine Model |

15. Revision history

Table 12. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|------------------------|---|--------------------|---------------|------------------------|
| 74AHC_AHCT132_Q100 v.2 | 20200703 | Product data sheet | - | 74AHC_AHCT132_Q100 v.1 |
| Modifications: | <ul style="list-style-type: none"> The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. Legal texts have been adapted to the new company name where appropriate. Section 1 and Section 2 updated. Table 4: Derating values for P_{tot} total power dissipation updated. Package outline drawing of SOT762-1 (Fig. 15) updated. | | | |
| 74AHC_AHCT132_Q100 v.1 | 20090504 | Product data sheet | - | - |

16. 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".
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