

74HC7014-Q100

Hex non-inverting precision Schmitt-trigger

Rev. 2 — 7 July 2022

Product data sheet

1. General description

The 74HC7014-Q100 is a hex buffer with precision Schmitt-trigger inputs. The precisely defined trigger levels are lying in a window between $0.55 \times V_{CC}$ and $0.65 \times V_{CC}$. It makes the circuit suitable to operate in a highly noisy environment. Input shorts are allowed to -1.5 V and +16 V without disturbing other channels. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC} . Schmitt trigger inputs transform 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

- 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 from 2.0 V to 6.0 V
- CMOS low power dissipation
- High noise immunity
- Unlimited input rise and fall times
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Complies with JEDEC standard no. 7A
- 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)

3. Applications

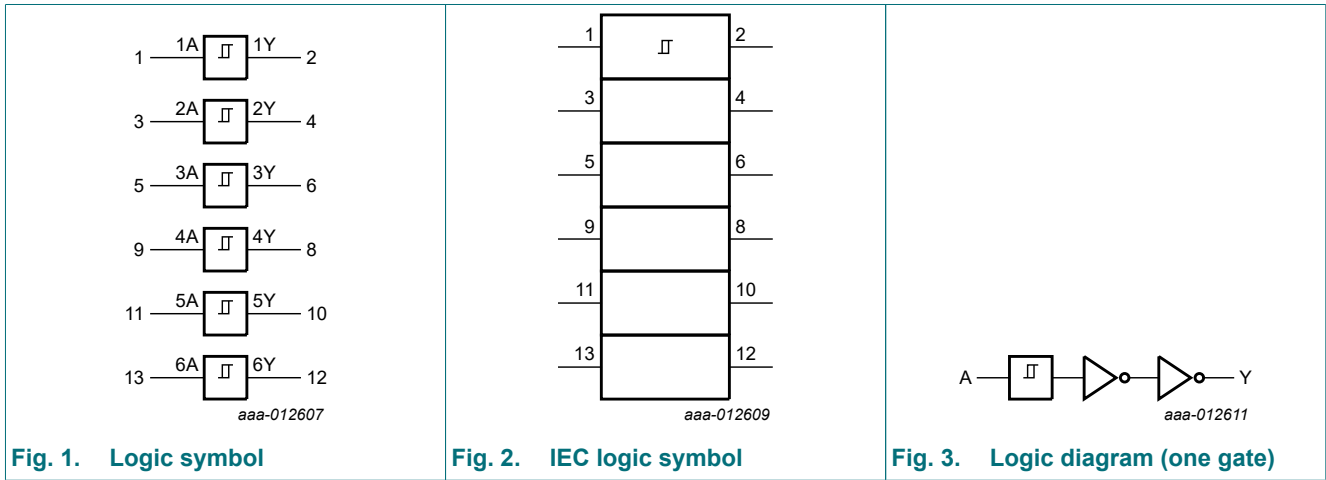
- Wave and pulse shapers for highly noisy environments

4. Ordering information

Table 1. Ordering information

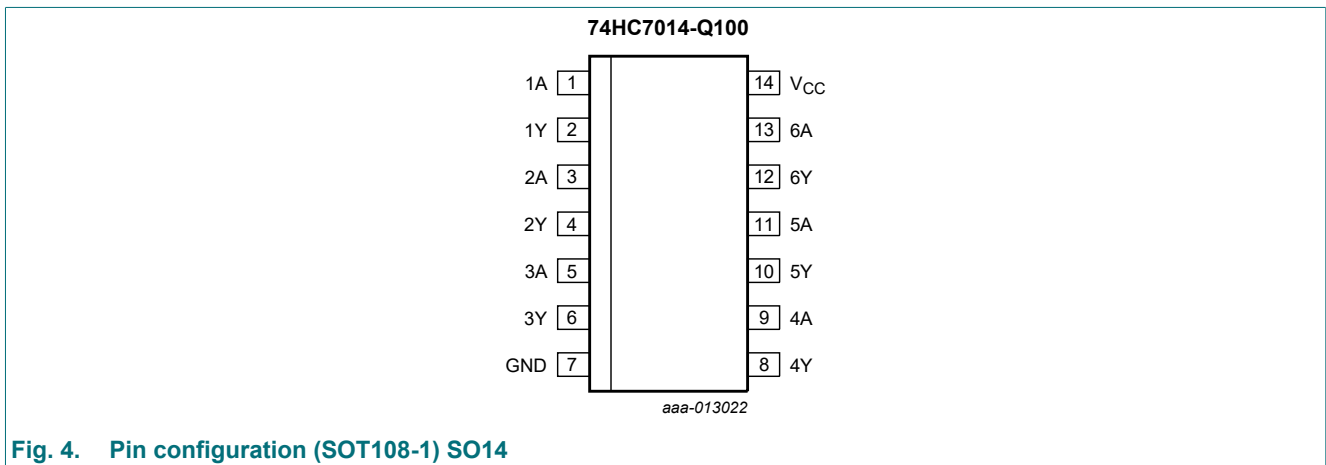
| Type number | Package | | | Version |
|--------------------------------|-------------------|------|---|--------------------------|
| | Temperature range | Name | Description | |
| 74HC7014D-Q100 | -40 °C to +125 °C | SO14 | plastic small outline package; 14 leads; body width 3.9 mm | SOT108-1 |

5. Functional diagram



6. Pinning information

6.1. Pinning



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 _{CC} | 14 | supply voltage |

7. Functional description

Table 3. Functional table

H = HIGH voltage level; L = LOW voltage level

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

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_{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 | SO14 package [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.

9. Recommended operating conditions

Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------|---------------------|------------|-----|-----|----------|------|
| V_{CC} | supply voltage | | 2.0 | 5.0 | 6.0 | V |
| V_I | input voltage | | 0 | - | V_{CC} | V |
| V_O | output voltage | | 0 | - | V_{CC} | V |
| T_{amb} | ambient temperature | | -40 | - | +125 | °C |

10. Static characteristics

Table 6. Static characteristics

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

| Symbol | Parameter | Conditions | T _{amb} = 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|-----------------|---------------------------|---|--------------------------|------|------|------------------|------|-------------------|------|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| V _{OH} | HIGH-level output voltage | V _I = V _{T+} or V _{T-} | | | | | | | | |
| | | I _O = -20 μA; V _{CC} = 2.0 V | 1.9 | 2.0 | - | 1.9 | - | 1.9 | - | V |
| | | I _O = -20 μA; V _{CC} = 4.5 V | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | I _O = -20 μA; V _{CC} = 6.0 V | 5.9 | 6.0 | - | 5.9 | - | 5.9 | - | V |
| | | I _O = -4.0 mA; V _{CC} = 4.5 V | 3.98 | 4.32 | - | 3.84 | - | 3.7 | - | V |
| | | I _O = -5.2 mA; V _{CC} = 6.0 V | 5.48 | 5.81 | - | 5.34 | - | 5.2 | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{T+} or V _{T-} | | | | | | | | |
| | | I _O = 20 μA; V _{CC} = 2.0 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 20 μA; V _{CC} = 4.5 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 20 μA; V _{CC} = 6.0 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 4.0 mA; V _{CC} = 4.5 V | - | 0.15 | 0.26 | - | 0.33 | - | 0.4 | V |
| | | I _O = 5.2 mA; V _{CC} = 6.0 V | - | 0.16 | 0.26 | - | 0.33 | - | 0.4 | V |
| I _I | input leakage current | V _{CC} = 6.00 V; V _I = V _{CC} or GND | - | - | 0.1 | 1.0 | - | 1.0 | - | μA |
| | | V _{CC} = 3.00 V to 6.00 V; V _I = 16 V or GND | - | - | 0.5 | 5.0 | - | 5.0 | - | μA |
| I _{CC} | DC supply current | V _{CC} = 3.00 V | - | 0.7 | 1.4 | - | 1.8 | - | 2.1 | mA |
| | | V _{CC} = 5.25 V | - | 3.0 | 6.0 | - | 7.5 | - | 7.5 | mA |
| | | V _{CC} = 6.00 V | - | 3.7 | 7.4 | - | 10.0 | - | 13.0 | mA |
| C _I | input capacitance | | - | 3.5 | - | - | - | - | pF | |

11. Dynamic characteristics

Table 7. Dynamic characteristics

$GND = 0\text{ V}$; for test circuit, see Fig. 6.

| Symbol | Parameter | Conditions | $T_{amb} = 25\text{ °C}$ | | | $-40\text{ °C to }+85\text{ °C}$ | | $-40\text{ °C to }+125\text{ °C}$ | | Unit |
|-----------|-------------------------------|---------------------------------------|--------------------------|-----|-----|----------------------------------|-----|-----------------------------------|-----|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| t_{PHL} | HIGH to LOW propagation delay | nA to nY; see Fig. 5 | | | | | | | | |
| | | $V_{CC} = 3.00\text{ V}$ | - | 95 | 475 | - | 600 | - | 715 | ns |
| | | $V_{CC} = 4.75\text{ V}$ | - | 38 | 115 | - | 145 | - | 175 | ns |
| | | $V_{CC} = 6.00\text{ V}$ | - | 27 | 73 | - | 93 | - | 112 | ns |
| t_{PLH} | LOW to HIGH propagation delay | nA to nY; see Fig. 5 | | | | | | | | |
| | | $V_{CC} = 3.00\text{ V}$ | - | 47 | 175 | - | 220 | - | 260 | ns |
| | | $V_{CC} = 4.75\text{ V}$ | - | 23 | 52 | - | 65 | - | 78 | ns |
| | | $V_{CC} = 6.00\text{ V}$ | - | 18 | 46 | - | 58 | - | 70 | ns |
| t_t | transition time | see Fig. 5 [1] | | | | | | | | |
| | | $V_{CC} = 3.00\text{ V}$ | - | 12 | 20 | - | 25 | - | 30 | ns |
| | | $V_{CC} = 4.75\text{ V}$ | - | 7 | 15 | - | 19 | - | 22 | ns |
| | | $V_{CC} = 6.00\text{ V}$ | - | 6 | 13 | - | 16 | - | 19 | ns |
| C_{PD} | power dissipation capacitance | per gate; $V_I = GND$ to V_{CC} [2] | - | 9 | - | - | - | - | - | pF |

[1] t_t is the same as t_{THL} and t_{TLH} .

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

$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$ 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 V;

N = number of inputs switching;

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

11.1. Waveforms and test circuit

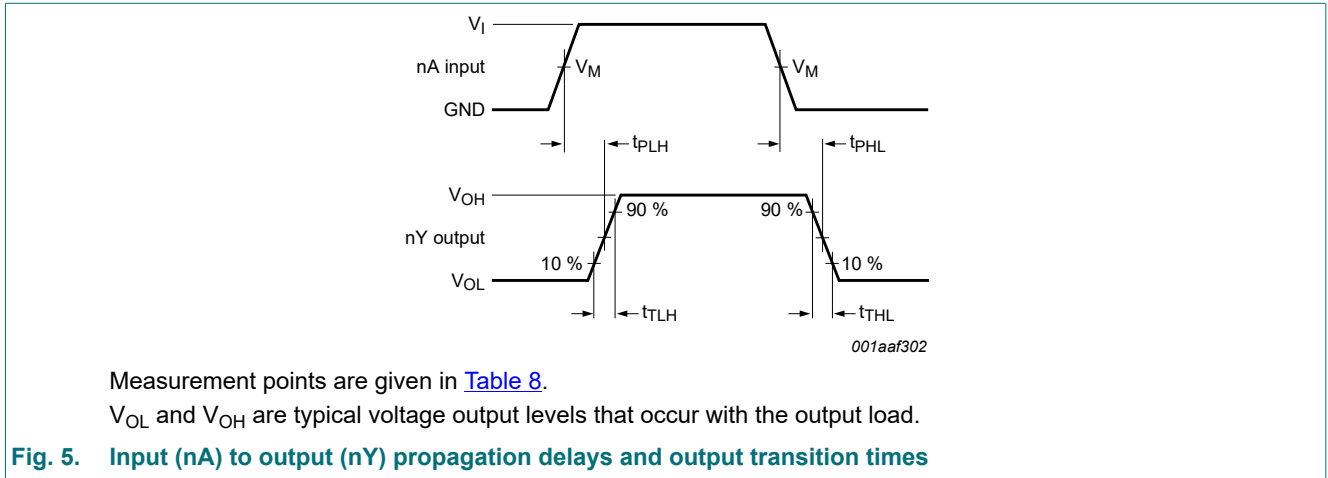


Table 8. Measurement points

| Type | Input | Output |
|---------------|---------------------|---------------------|
| | V_M | V_M |
| 74HC7014-Q100 | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |

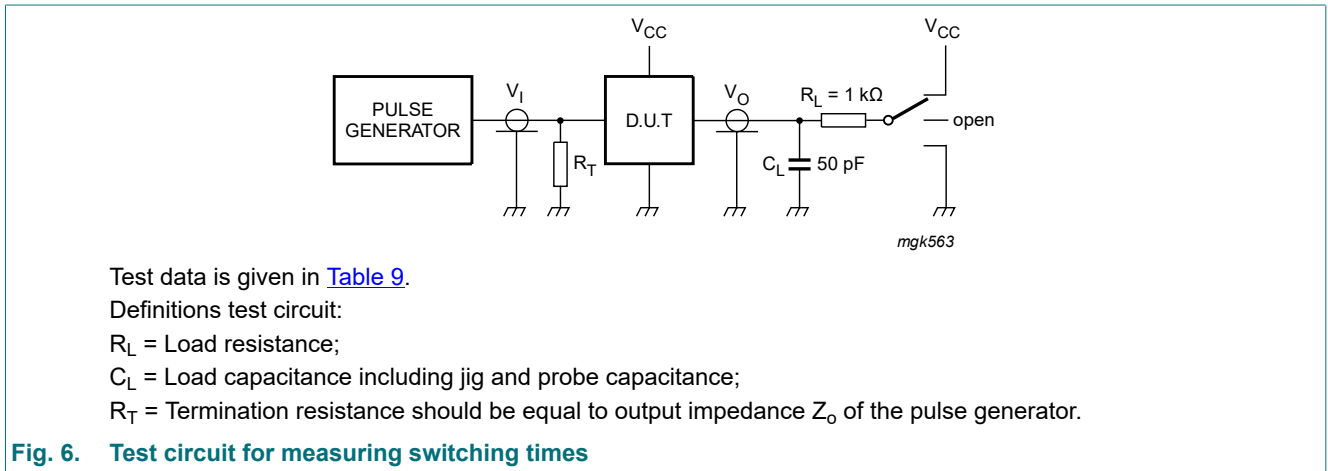


Table 9. Test data

| Type | Input | Test |
|---------------|-----------------|--------------------|
| | V_I | t_r, t_f |
| 74HC7014-Q100 | GND to V_{CC} | t_{PHL}, t_{PLH} |
| | | 6 ns |
| | | open |

12. Transfer characteristics

Table 10. Transfer characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); see Fig. 7 and Fig. 8.

| Symbol | Parameter | Conditions | T _{amb} = 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|-----------------|----------------------------------|--------------------------|--------------------------|------|------|------------------|------|-------------------|------|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| V _{T+} | positive-going threshold voltage | V _{CC} = 3.00 V | - | 1.86 | 1.95 | - | 1.95 | - | 1.95 | V |
| | | V _{CC} = 4.75 V | - | 2.94 | 3.08 | - | 3.08 | - | 3.08 | V |
| | | V _{CC} = 5.00 V | - | 3.10 | 3.25 | - | 3.25 | - | 3.25 | V |
| | | V _{CC} = 5.25 V | - | 3.25 | 3.41 | - | 3.41 | - | 3.41 | V |
| | | V _{CC} = 6.00 V | - | 3.72 | 3.90 | - | 3.90 | - | 3.90 | V |
| V _{T-} | negative-going threshold voltage | V _{CC} = 3.00 V | 1.65 | 1.74 | - | 1.65 | - | 1.65 | - | V |
| | | V _{CC} = 4.75 V | 2.62 | 2.76 | - | 2.62 | - | 2.62 | - | V |
| | | V _{CC} = 5.00 V | 2.75 | 2.90 | - | 2.75 | - | 2.75 | - | V |
| | | V _{CC} = 5.25 V | 2.89 | 3.05 | - | 2.89 | - | 2.89 | - | V |
| | | V _{CC} = 6.00 V | 3.30 | 3.48 | - | 3.30 | - | 3.30 | - | V |
| V _H | hysteresis voltage | V _{CC} = 3.00 V | 50 | 120 | - | 50 | - | 50 | - | mV |
| | | V _{CC} = 4.75 V | 100 | 180 | - | 100 | - | 100 | - | mV |
| | | V _{CC} = 5.00 V | 120 | 200 | - | 120 | - | 120 | - | mV |
| | | V _{CC} = 5.25 V | 130 | 210 | - | 130 | - | 130 | - | mV |
| | | V _{CC} = 6.00 V | 160 | 240 | - | 160 | - | 160 | - | mV |

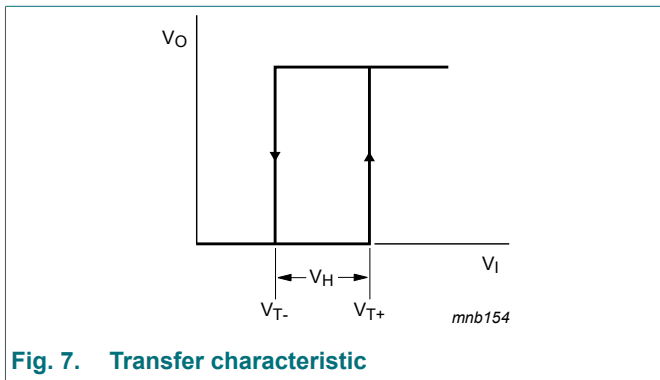


Fig. 7. Transfer characteristic

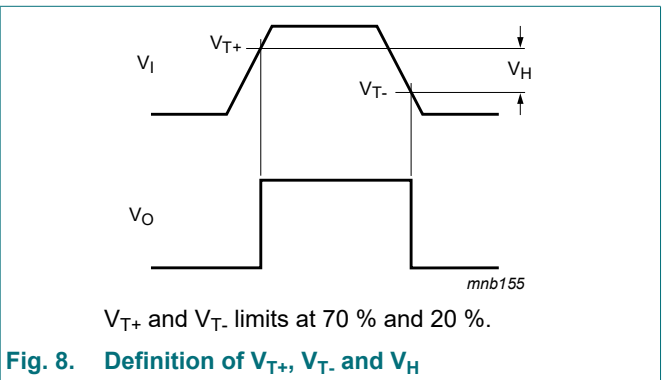


Fig. 8. Definition of V_{T+}, V_{T-} and V_H

13. Package outline

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

SOT108-1

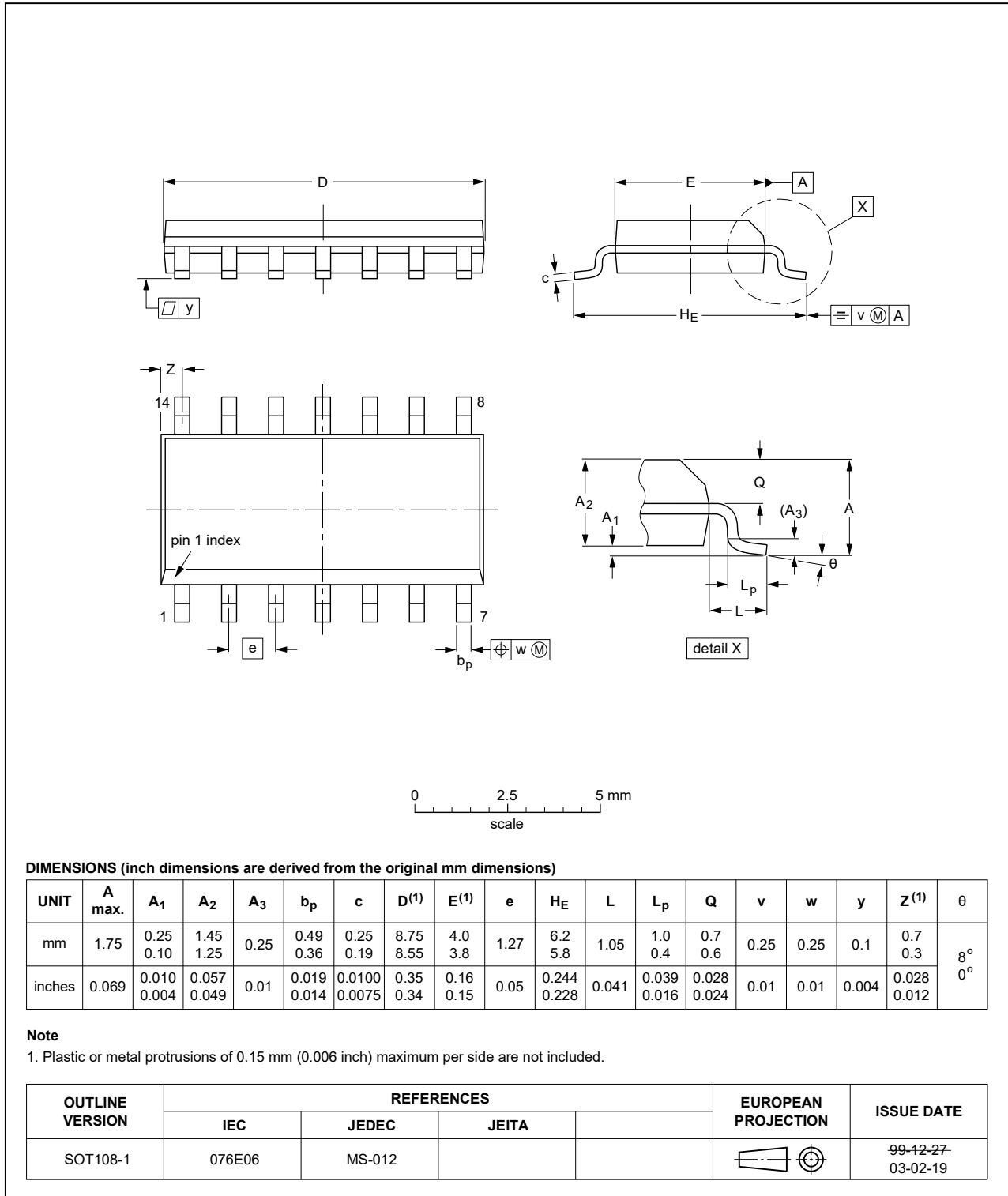


Fig. 9. Package outline SOT108-1 (SO14)

14. Abbreviations

Table 11. Abbreviations

| Acronym | Description |
|---------|-------------------------|
| DUT | Device Under Test |
| ESD | ElectroStatic Discharge |
| HBM | Human Body Model |
| MM | Machine Model |

15. Revision history

Table 12. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|-------------------|--|--------------------|---------------|-------------------|
| 74HC7014_Q100 v.2 | 20220707 | Product data sheet | - | 74HC7014_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 2 updated. Table 4: Derating values for P_{tot} total power dissipation updated. Table 7: Values added for $T_{PHL(max)}$ at $T_{amb} = -40\text{ °C}$ to $+85\text{ °C}$. (errata) Table 10: Unit of hysteresis voltage changed to millivolts. (errata) | | | |
| 74HC7014_Q100 v.1 | 20140526 | 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. |
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| Product [short] data sheet | Production | This document contains the product specification. |

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Date of release: 7 July 2022
