



**THE DATASHEET OF
74HC74PW-Q100,118**



74HC74-Q100; 74HCT74-Q100

Dual D-type flip-flop with set and reset; positive edge-trigger

Rev. 5 — 2 April 2024

Product data sheet

1. General description

The 74HC74-Q100; 74HCT74-Q100 are dual positive edge triggered D-type flip-flop with individual data (nD), clock (nCP), set (nSD) and reset (nRD) inputs, and complementary nQ and nQ outputs. Data at the nD-input, that meets the set-up and hold time requirements on the LOW-to-HIGH clock transition, will be stored in the flip-flop and appear at the nQ output. The Schmitt-trigger action in the clock input, makes the circuit highly tolerant to slower clock rise and fall times. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC} .

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

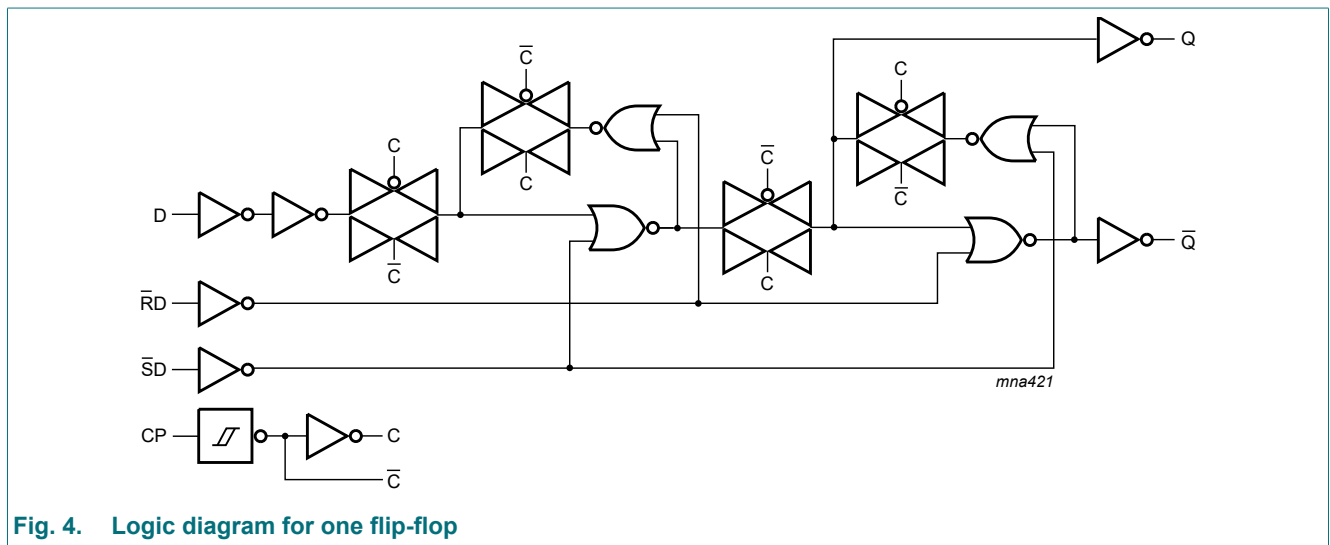
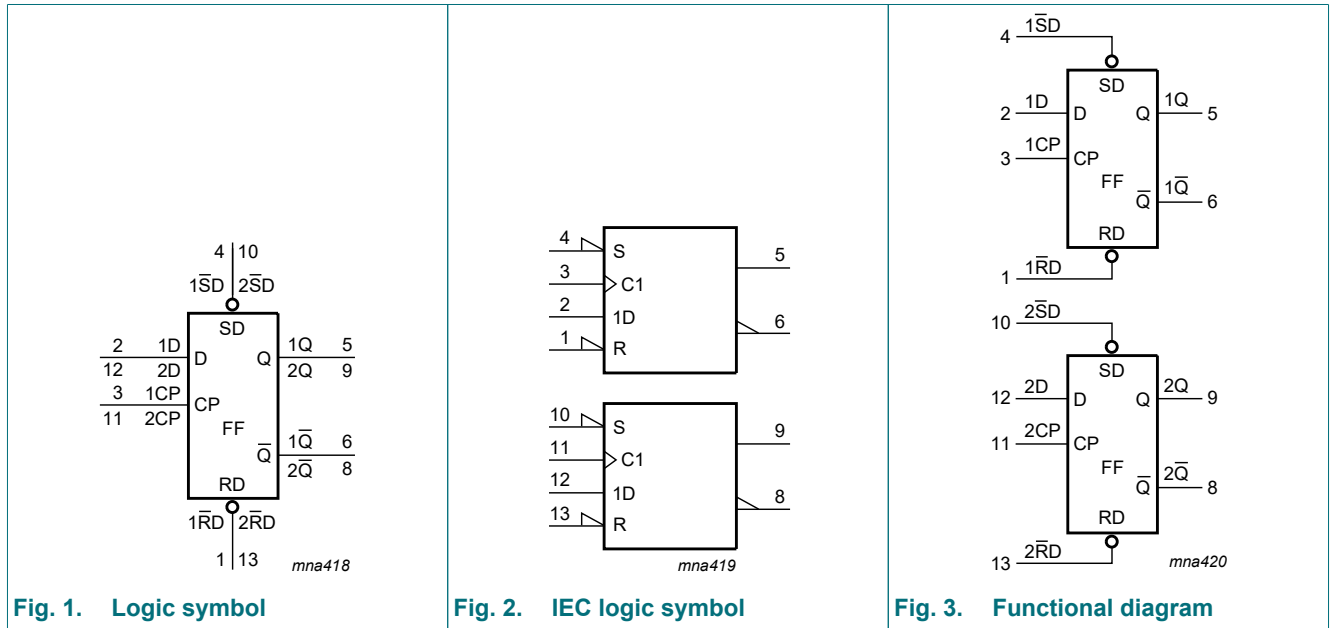
- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
 - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- Input levels:
 - For 74HC74-Q100: CMOS level
 - For 74HCT74-Q100: TTL level
- Symmetrical output impedance
- Low power dissipation
- High noise immunity
- Balanced propagation delays
- Specified in compliance with JEDEC standard no. 7A
- ESD protection:
 - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
 - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Multiple package options
- DHVQFN package with Side-Wettable Flanks enabling Automatic Optical Inspection (AOI) of solder joints

3. Ordering information

Table 1. Ordering information

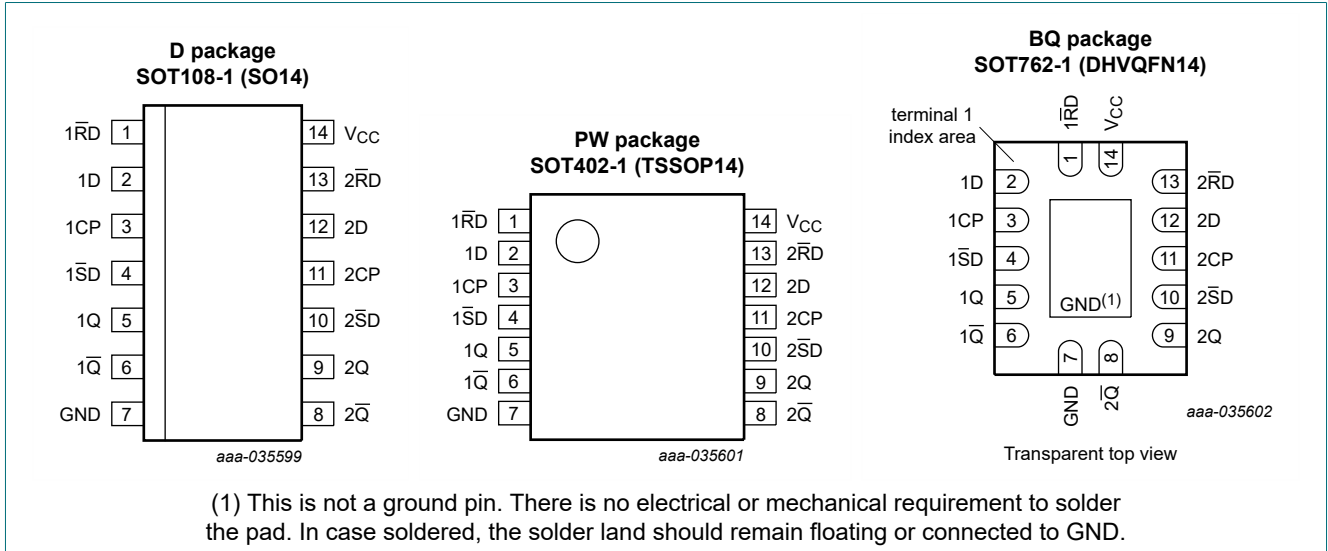
| Type number | Package | | | Version |
|---|-------------------|----------|--|--------------------------|
| | Temperature range | Name | Description | |
| 74HC74D-Q100 74HCT74D-Q100 | -40 °C to +125 °C | SO14 | plastic small outline package; 14 leads; body width 3.9 mm | SOT108-1 |
| 74HC74PW-Q100 74HCT74PW-Q100 | -40 °C to +125 °C | TSSOP14 | plastic thin shrink small outline package; 14 leads; body width 4.4 mm | SOT402-1 |
| 74HC74BQ-Q100 74HCT74BQ-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 |

4. Functional diagram



5. Pinning information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

| Symbol | Pin | Description |
|--------|-----|--|
| 1RD | 1 | asynchronous reset-direct input (active LOW) |
| 1D | 2 | data input |
| 1CP | 3 | clock input (LOW-to-HIGH, edge-triggered) |
| 1SD | 4 | asynchronous set-direct input (active LOW) |
| 1Q | 5 | output |
| 1Q | 6 | complement output |
| GND | 7 | ground (0 V) |
| 2Q | 8 | complement output |
| 2Q | 9 | output |
| 2SD | 10 | asynchronous set-direct input (active LOW) |
| 2CP | 11 | clock input (LOW-to-HIGH, edge-triggered) |
| 2D | 12 | data input |
| 2RD | 13 | asynchronous reset-direct input (active LOW) |
| VCC | 14 | supply voltage |

6. Functional description

Table 3. Function table

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

| Input | | | | Output | |
|-------|-----|-----|----|--------|-----|
| nSD | nRD | nCP | nD | nQ | nQ̄ |
| L | H | X | X | H | L |
| H | L | X | X | L | H |
| L | L | X | X | H | H |

Table 4. Function table

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

↑ = LOW-to-HIGH transition; Q_{n+1} = state after the next LOW-to-HIGH CP transition.

| Input | | | | Output | |
|-------|-----|-----|----|-------------------|--------------------|
| nSD | nRD | nCP | nD | nQ _{n+1} | nQ̄ _{n+1} |
| H | H | ↑ | L | L | H |
| H | H | ↑ | H | H | L |

7. Limiting values

Table 5. 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 V or V _I > V _{CC} + 0.5 V | - | ±20 | mA |
| I _{OK} | output clamping current | V _O < -0.5 V or V _O > V _{CC} + 0.5 V | - | ±20 | mA |
| I _O | output current | V _O = -0.5 V to (V _{CC} + 0.5 V) | - | ±25 | mA |
| I _{CC} | supply current | | - | +100 | mA |
| I _{GND} | ground current | | -100 | - | mA |
| T _{stg} | storage temperature | | -65 | +150 | °C |
| P _{tot} | total power dissipation | T _{amb} = -40 °C to +125 °C SOT108-1 (SO14) SOT402-1 (TSSOP14) SOT762-1 (DHVQFN14) | - | 500 | mW |

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

[2] For SOT402-1 (TSSOP14) package: P_{tot} derates linearly with 7.3 mW/K above 81 °C.

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

8. Recommended operating conditions

Table 6. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V)

| Symbol | Parameter | Conditions | 74HC74-Q100 | | | 74HCT74-Q100 | | | 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 | +25 | +125 | -40 | +25 | +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 7. Static characteristics

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

| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | -40 °C to +125 °C | | Unit |
|---------------------|---------------------------|--|------------------|---------|------|-------------------|------|------|
| | | | Min | Typ [1] | Max | Min | Max | |
| 74HC74-Q100 | | | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 2.0 V | 1.5 | 1.2 | - | 1.5 | - | V |
| | | V _{CC} = 4.5 V | 3.15 | 2.4 | - | 3.15 | - | V |
| | | V _{CC} = 6.0 V | 4.2 | 3.2 | - | 4.2 | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 2.0 V | - | 0.8 | 0.5 | - | 0.5 | V |
| | | V _{CC} = 4.5 V | - | 2.1 | 1.35 | - | 1.35 | V |
| | | V _{CC} = 6.0 V | - | 2.8 | 1.8 | - | 1.8 | V |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} | | | | | | |
| | | I _O = -4.0 mA; V _{CC} = 4.5 V | 3.84 | 4.32 | - | 3.7 | - | V |
| | | I _O = -5.2 mA; V _{CC} = 6.0 V | 5.34 | 5.81 | - | 5.2 | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} | | | | | | |
| | | I _O = 4.0 mA; V _{CC} = 4.5 V | - | 0.15 | 0.33 | - | 0.4 | V |
| | | I _O = 5.2 mA; V _{CC} = 6.0 V | - | 0.16 | 0.33 | - | 0.4 | V |
| I _I | input leakage current | V _I = V _{CC} or GND; V _{CC} = 6.0 V | - | - | ±1.0 | - | ±1.0 | µA |
| I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 6.0 V | - | - | 40 | - | 80 | µA |
| C _I | input capacitance | | - | 3.5 | - | - | - | pF |
| 74HCT74-Q100 | | | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 4.5 V to 5.5 V | 2.0 | 1.6 | - | 2.0 | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 4.5 V to 5.5 V | - | 1.2 | 0.8 | - | 0.8 | V |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V | | | | | | |
| | | I _O = -4 mA | 3.84 | 4.32 | - | 3.7 | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V | | | | | | |
| | | I _O = 4.0 mA | - | 0.15 | 0.33 | - | 0.4 | V |
| I _I | input leakage current | V _I = V _{CC} or GND; V _{CC} = 5.5 V | - | - | ±1.0 | - | ±1.0 | µA |
| I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V | - | - | 40 | - | 80 | µA |
| ΔI _{CC} | additional supply current | V _I = V _{CC} - 2.1 V; other inputs at V _{CC} or GND; V _{CC} = 4.5 V to 5.5 V; I _O = 0 A | | | | | | |
| | | per input pin; nD, nRD inputs | - | 70 | 315 | - | 343 | µA |
| | | per input pin; nSD, nCP input | - | 80 | 360 | - | 392 | µA |
| C _I | input capacitance | | - | 3.5 | - | - | - | pF |

[1] All typical values are measured at T_{amb} = 25 °C.

10. Dynamic characteristics

Table 8. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); $C_L = 50$ pF unless otherwise specified; for test circuit see Fig. 7.

| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | -40 °C to +125 °C | | Unit |
|--------------------|-------------------|--|------------------|---------|-----|-------------------|-----|------|
| | | | Min | Typ [1] | Max | Min | Max | |
| 74HC74-Q100 | | | | | | | | |
| t_{pd} | propagation delay | nCP to nQ, n \bar{Q} ; see Fig. 5 [2] | | | | | | |
| | | $V_{CC} = 2.0$ V | - | 47 | 220 | - | 265 | ns |
| | | $V_{CC} = 4.5$ V | - | 17 | 44 | - | 53 | ns |
| | | $V_{CC} = 5$ V; $C_L = 15$ pF | - | 14 | - | - | - | ns |
| | | $V_{CC} = 6.0$ V | - | 14 | 37 | - | 45 | ns |
| | | n $\bar{S}D$ to nQ, n \bar{Q} ; see Fig. 6 [2] | | | | | | |
| | | $V_{CC} = 2.0$ V | - | 50 | 250 | - | 300 | ns |
| | | $V_{CC} = 4.5$ V | - | 18 | 50 | - | 60 | ns |
| | | $V_{CC} = 5$ V; $C_L = 15$ pF | - | 15 | - | - | - | ns |
| | | $V_{CC} = 6.0$ V | - | 14 | 43 | - | 51 | ns |
| | | n $\bar{R}D$ to nQ, n \bar{Q} ; see Fig. 6 [2] | | | | | | |
| | | $V_{CC} = 2.0$ V | - | 52 | 250 | - | 300 | ns |
| | | $V_{CC} = 4.5$ V | - | 19 | 50 | - | 60 | ns |
| | | $V_{CC} = 5$ V; $C_L = 15$ pF | - | 16 | - | - | - | ns |
| $V_{CC} = 6.0$ V | - | 15 | 43 | - | 51 | ns | | |
| t_t | transition time | nQ, n \bar{Q} ; see Fig. 5 [3] | | | | | | |
| | | $V_{CC} = 2.0$ V | - | 19 | 95 | - | 110 | ns |
| | | $V_{CC} = 4.5$ V | - | 7 | 19 | - | 22 | ns |
| | | $V_{CC} = 6.0$ V | - | 6 | 16 | - | 19 | ns |
| t_w | pulse width | nCP HIGH or LOW; see Fig. 5 | | | | | | |
| | | $V_{CC} = 2.0$ V | 100 | 19 | - | 120 | - | ns |
| | | $V_{CC} = 4.5$ V | 20 | 7 | - | 24 | - | ns |
| | | $V_{CC} = 6.0$ V | 17 | 6 | - | 20 | - | ns |
| | | n $\bar{S}D$, n $\bar{R}D$ LOW; see Fig. 6 | | | | | | |
| | | $V_{CC} = 2.0$ V | 100 | 19 | - | 120 | - | ns |
| | | $V_{CC} = 4.5$ V | 20 | 7 | - | 24 | - | ns |
| $V_{CC} = 6.0$ V | 17 | 6 | - | 20 | - | ns | | |
| t_{rec} | recovery time | n $\bar{S}D$, n $\bar{R}D$; see Fig. 6 | | | | | | |
| | | $V_{CC} = 2.0$ V | 40 | 3 | - | 45 | - | ns |
| | | $V_{CC} = 4.5$ V | 8 | 1 | - | 9 | - | ns |
| | | $V_{CC} = 6.0$ V | 7 | 1 | - | 8 | - | ns |

Dual D-type flip-flop with set and reset; positive edge-trigger

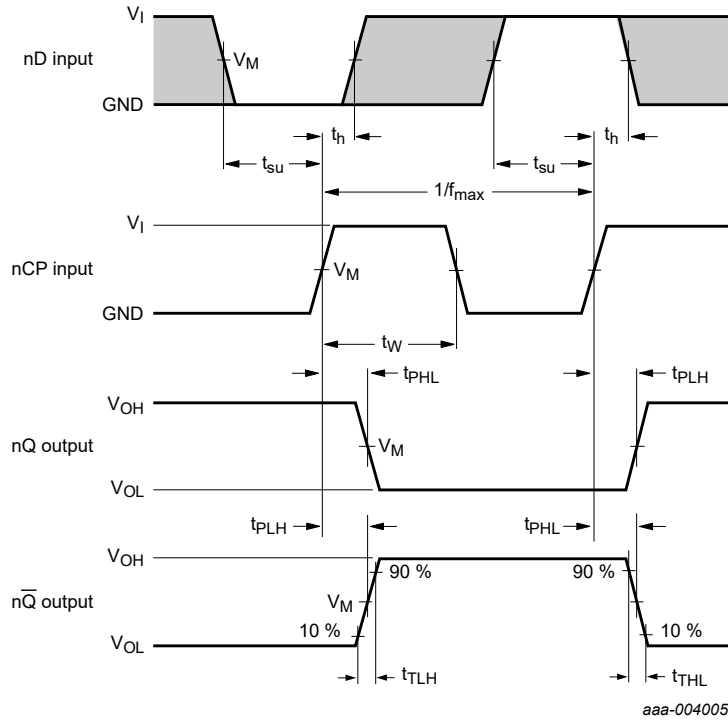
| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | -40 °C to +125 °C | | Unit |
|------------------|-------------------------------|---|------------------|---------|-----|-------------------|-----|------|
| | | | Min | Typ [1] | Max | Min | Max | |
| t _{su} | set-up time | nD to nCP; see Fig. 5 | | | | | | |
| | | V _{CC} = 2.0 V | 75 | 6 | - | 90 | - | ns |
| | | V _{CC} = 4.5 V | 15 | 2 | - | 18 | - | ns |
| | | V _{CC} = 6.0 V | 13 | 2 | - | 15 | - | ns |
| t _h | hold time | nD to nCP; see Fig. 5 | | | | | | |
| | | V _{CC} = 2.0 V | 3 | -6 | - | 3 | - | ns |
| | | V _{CC} = 4.5 V | 3 | -2 | - | 3 | - | ns |
| | | V _{CC} = 6.0 V | 3 | -2 | - | 3 | - | ns |
| f _{max} | maximum frequency | nCP; see Fig. 5 | | | | | | |
| | | V _{CC} = 2.0 V | 4.8 | 23 | - | 4.0 | - | MHz |
| | | V _{CC} = 4.5 V | 24 | 69 | - | 20 | - | MHz |
| | | V _{CC} = 5 V; C _L = 15 pF | - | 76 | - | - | - | MHz |
| | | V _{CC} = 6.0 V | 28 | 82 | - | 24 | - | MHz |
| C _{PD} | power dissipation capacitance | C _L = 50 pF; f = 1 MHz; V _I = GND to V _{CC} [4] | - | 24 | - | - | - | pF |

Dual D-type flip-flop with set and reset; positive edge-trigger

| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | -40 °C to +125 °C | | Unit |
|---------------------|-------------------------------|--|------------------|---------|-----|-------------------|-----|------|
| | | | Min | Typ [1] | Max | Min | Max | |
| 74HCT74-Q100 | | | | | | | | |
| t _{pd} | propagation delay | nCP to nQ, nQ̄; see Fig. 5 [2] | | | | | | |
| | | V _{CC} = 4.5 V | - | 18 | 44 | - | 53 | ns |
| | | V _{CC} = 5 V; C _L = 15 pF | - | 15 | - | - | - | ns |
| | | nSD to nQ, nQ̄; see Fig. 6 [2] | | | | | | |
| | | V _{CC} = 4.5 V | - | 23 | 50 | - | 60 | ns |
| | | V _{CC} = 5 V; C _L = 15 pF | - | 18 | - | - | - | ns |
| | | nRD to nQ, nQ̄; see Fig. 6 [2] | | | | | | |
| | | V _{CC} = 4.5 V | - | 24 | 50 | - | 60 | ns |
| t _t | transition time | nQ, nQ̄; see Fig. 5 [3] | | | | | | |
| | | V _{CC} = 4.5 V | - | 7 | 19 | - | 22 | ns |
| t _w | pulse width | nCP HIGH or LOW; see Fig. 5 | | | | | | |
| | | V _{CC} = 4.5 V | 23 | 9 | - | 27 | - | ns |
| | | nSD, nRD LOW; see Fig. 6 | | | | | | |
| | | V _{CC} = 4.5 V | 20 | 9 | - | 24 | - | ns |
| t _{rec} | recovery time | nSD, nRD; see Fig. 6 | | | | | | |
| | | V _{CC} = 4.5 V | 8 | 1 | - | 9 | - | ns |
| t _{su} | set-up time | nD to nCP; see Fig. 5 | | | | | | |
| | | V _{CC} = 4.5 V | 15 | 5 | - | 18 | - | ns |
| t _h | hold time | nD to nCP; see Fig. 5 | | | | | | |
| | | V _{CC} = 4.5 V | 3 | -3 | - | 3 | - | ns |
| f _{max} | maximum frequency | nCP; see Fig. 5 | | | | | | |
| | | V _{CC} = 4.5 V | 22 | 54 | - | 18 | - | MHz |
| | | V _{CC} = 5 V; C _L = 15 pF | - | 59 | - | - | - | MHz |
| C _{PD} | power dissipation capacitance | C _L = 50 pF; f = 1 MHz; V _I = GND to V _{CC} - 1.5 V [4] | - | 29 | - | - | - | pF |

- [1] All typical values are measured at T_{amb} = 25 °C.
- [2] t_{pd} is the same as t_{PLH} and t_{PHL}.
- [3] t_t is the same as t_{THL} and t_{TLH}.
- [4] 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.

10.1. Waveforms and test circuit

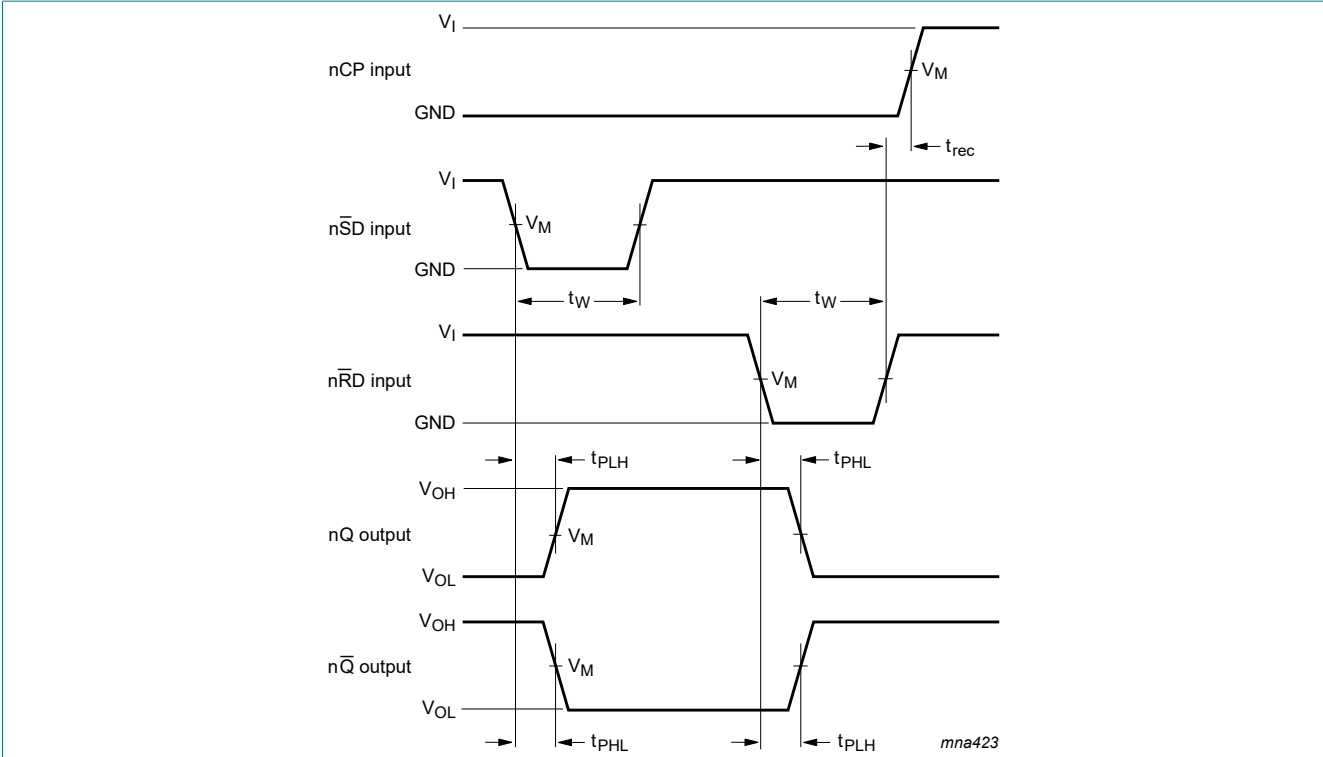


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Measurement points are given in [Table 9](#).

V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

Fig. 5. Propagation delay input (CP) to output (Qn), output transition time, clock input (CP) pulse width and the maximum frequency (CP)



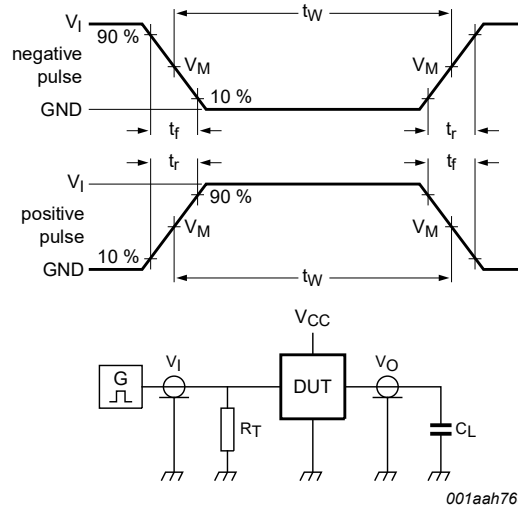
Measurement points are given in [Table 9](#).

V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

Fig. 6. The set ($n\bar{SD}$) and reset ($n\bar{RD}$) input to output ($nQ, n\bar{Q}$) propagation delays, set and reset pulse widths and the $n\bar{SD}, n\bar{RD}$ to nCP recovery time

Table 9. Measurement points

| Type | Input | Output |
|--------------|-------------|-------------|
| | V_M | V_M |
| 74HC74-Q100 | $0.5V_{CC}$ | $0.5V_{CC}$ |
| 74HCT74-Q100 | 1.3 V | 1.3 V |



Test data is given in [Table 10](#).

Definitions test circuit:

R_T = Termination resistance should be equal to output impedance Z_o of the pulse generator.

C_L = Load capacitance including jig and probe capacitance.

R_L = Load resistance.

S1 = Test selection switch.

Fig. 7. Test circuit for measuring switching times

Table 10. Test data

| Type | Input | | Load | | Test |
|--------------|----------|------------|--------------|--------------|--------------------|
| | V_I | t_r, t_f | C_L | R_L | |
| 74HC74-Q100 | V_{CC} | 6 ns | 15 pF, 50 pF | 1 k Ω | t_{PLH}, t_{PHL} |
| 74HCT74-Q100 | 3 V | 6 ns | 15 pF, 50 pF | 1 k Ω | t_{PLH}, t_{PHL} |

11. Package outline

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

SOT108-1

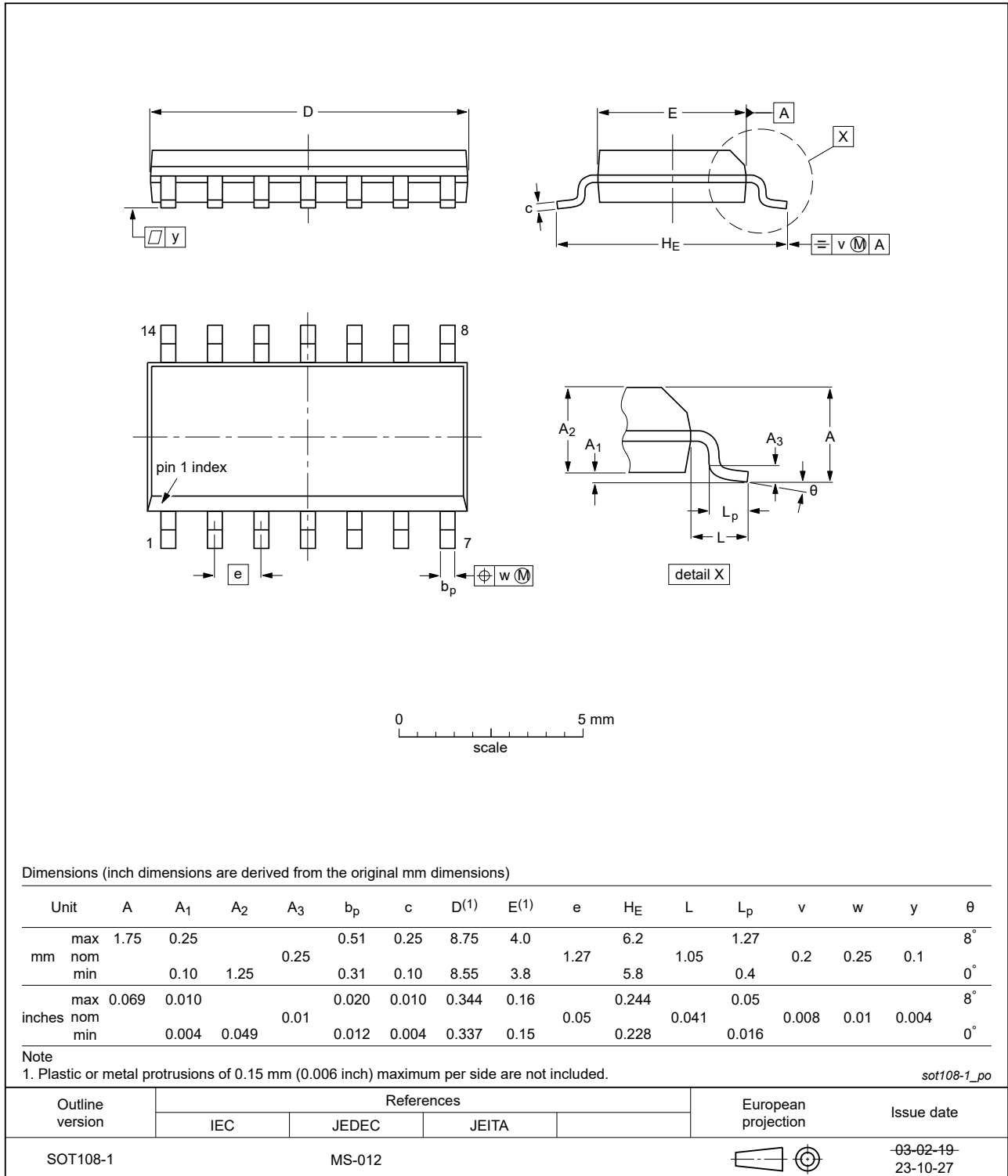


Fig. 8. Package outline SOT108-1 (SO14)

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

SOT402-1

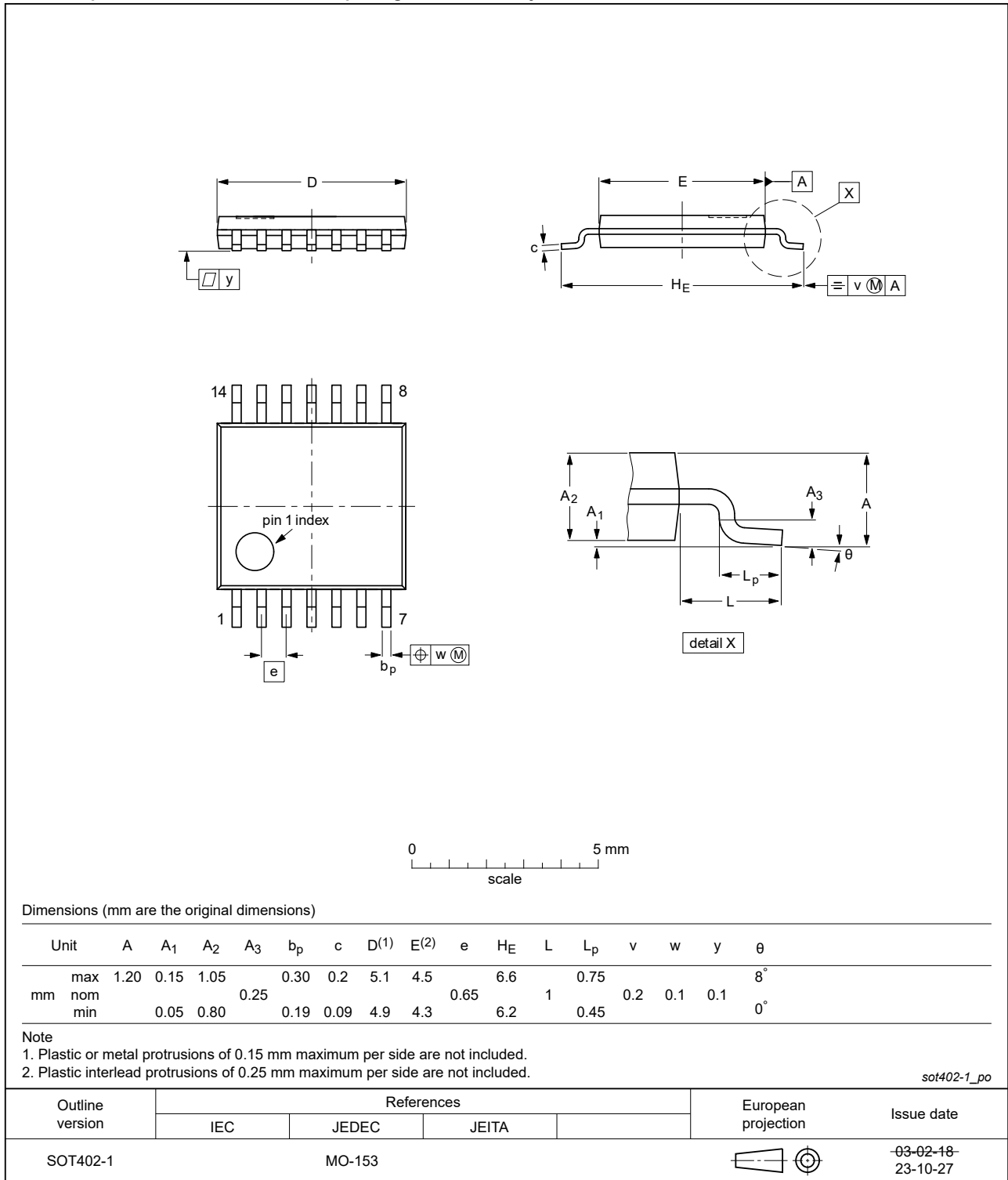


Fig. 9. Package outline SOT402-1 (TSSOP14)

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

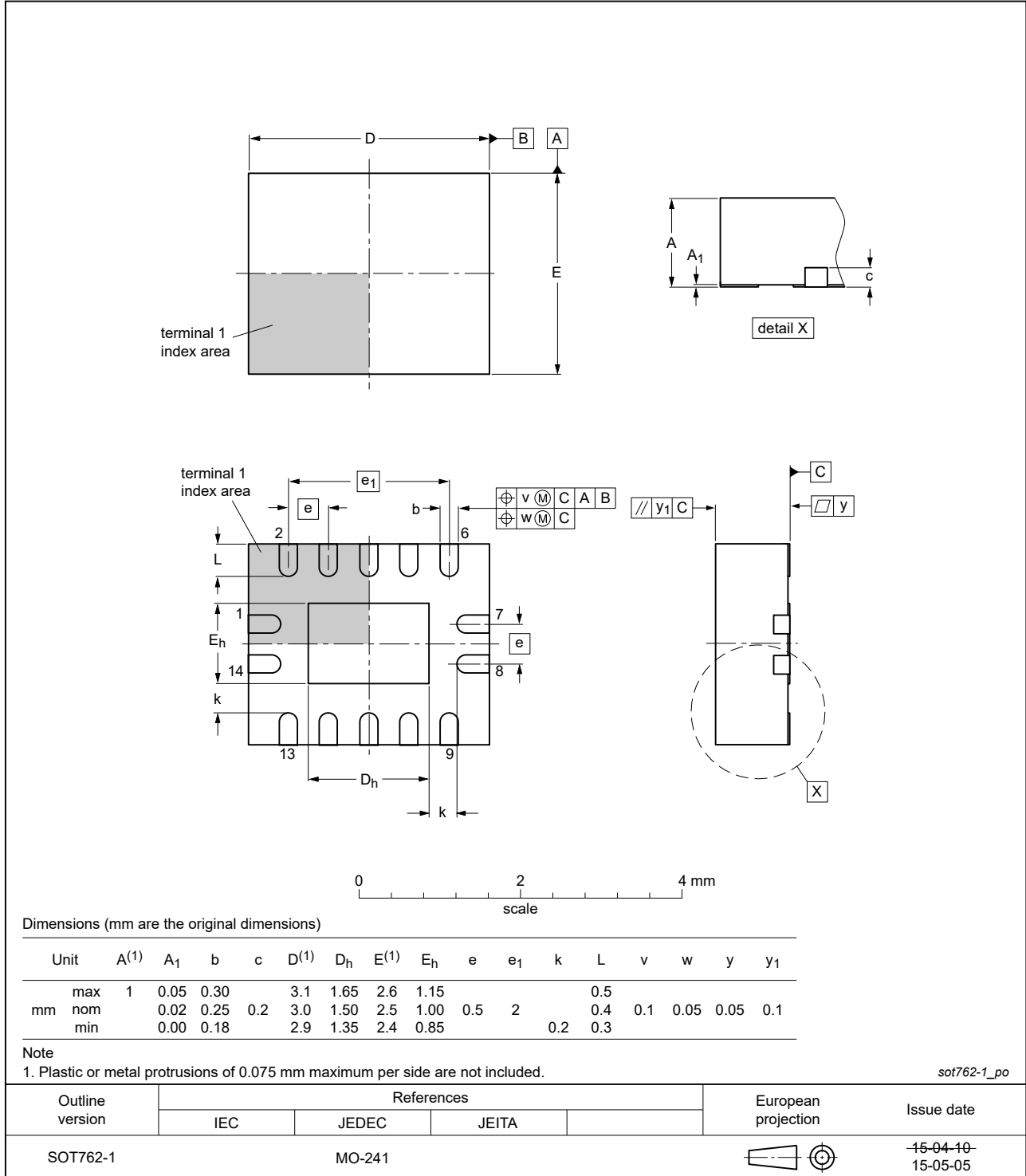


Fig. 10. Package outline SOT762-1 (DHVQFN14)

12. Abbreviations

Table 11. Abbreviations

| Acronym | Description |
|---------|---|
| CDM | Charged Device Model |
| CMOS | Complementary Metal Oxide Semiconductor |
| ESD | ElectroStatic Discharge |
| HBM | Human Body Model |
| TTL | Transistor-Transistor Logic |

13. Revision history

Table 12. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---------------------|---|--------------------|---------------|---------------------|
| 74HC_HCT74_Q100 v.5 | 20240402 | Product data sheet | - | 74HC_HCT74_Q100 v.4 |
| Modifications: | <ul style="list-style-type: none"> • Fig. 8, Fig. 9: Aligned SO and TSSOP package outline drawings to JEDEC MS-012 and MO-153. • Section 2: ESD specification updated according to the latest JEDEC standard. | | | |
| 74HC_HCT74_Q100 v.4 | 20200421 | Product data sheet | - | 74HC_HCT74_Q100 v.3 |
| 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 5: Derating values for P_{tot} total power dissipation updated. | | | |
| 74HC_HCT74_Q100 v.3 | 20151204 | Product data sheet | - | 74HC_HCT74_Q100 v.2 |
| Modifications: | <ul style="list-style-type: none"> • Type number 74HC74N-Q100 (SOT27-1) removed. | | | |
| 74HC_HCT74_Q100 v.2 | 20130906 | Product data sheet | - | 74HC_HCT74_Q100 v.1 |
| Modifications: | <ul style="list-style-type: none"> • 74HC74N-Q100 (DIP14) added. | | | |
| 74HC_HCT74_Q100 v.1 | 20120807 | Product data sheet | - | - |

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.
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