

# 74HC4040-Q100; 74HCT4040-Q100

12-stage binary ripple counter

Rev. 4 — 16 February 2024

Product data sheet

## 1. General description

The 74HC4040-Q100; 74HCT4040-Q100 is a 12-stage binary ripple counter with a clock input ( $\overline{CP}$ ), an overriding asynchronous master reset input (MR) and twelve parallel outputs (Q0 to Q11). The counter advances on the HIGH-to-LOW transition of  $\overline{CP}$ . A HIGH on MR clears all counter stages and forces all outputs LOW, independent of the state of  $\overline{CP}$ . Each counter stage is a static toggle flip-flop. Inputs include clamp diodes that enable 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
- Wide supply voltage range from 2.0 V to 6.0 V
- CMOS low power dissipation
- High noise immunity
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Complies with JEDEC standards:
  - JESD8C (2.7 V to 3.6 V)
  - JESD7A (2.0 V to 6.0 V)
- Input levels:
  - For 74HC4040-Q100: CMOS level
  - For 74HCT4040-Q100: TTL level
- 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. Applications

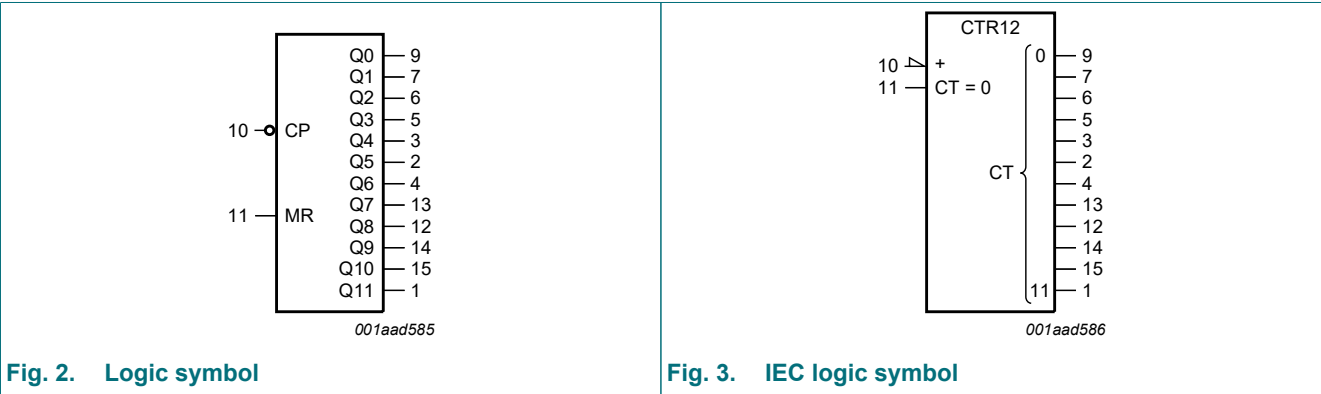
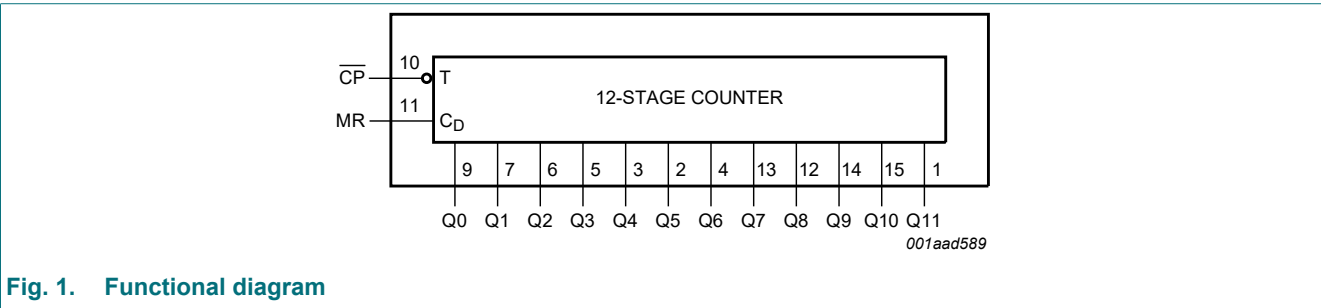
- Frequency dividing circuits
- Time delay circuits
- Control counters

4. Ordering information

Table 1. Ordering information

| Type number                                                         | Package           |          |                                                                                                                                         |                          |
|---------------------------------------------------------------------|-------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
|                                                                     | Temperature range | Name     | Description                                                                                                                             | Version                  |
| <a href="#">74HC4040D-Q100</a><br><a href="#">74HCT4040D-Q100</a>   | -40 °C to +125 °C | SO16     | plastic small outline package; 16 leads;<br>body width 3.9 mm                                                                           | <a href="#">SOT109-1</a> |
| <a href="#">74HC4040PW-Q100</a><br><a href="#">74HCT4040PW-Q100</a> | -40 °C to +125 °C | TSSOP16  | plastic thin shrink small outline package;<br>16 leads; body width 4.4 mm                                                               | <a href="#">SOT403-1</a> |
| <a href="#">74HC4040BQ-Q100</a><br><a href="#">74HCT4040BQ-Q100</a> | -40 °C to +125 °C | DHVQFN16 | plastic dual in-line compatible<br>thermal enhanced very thin quad<br>flat package; no leads; 16 terminals;<br>body 2.5 × 3.5 × 0.85 mm | <a href="#">SOT763-1</a> |

5. Functional diagram



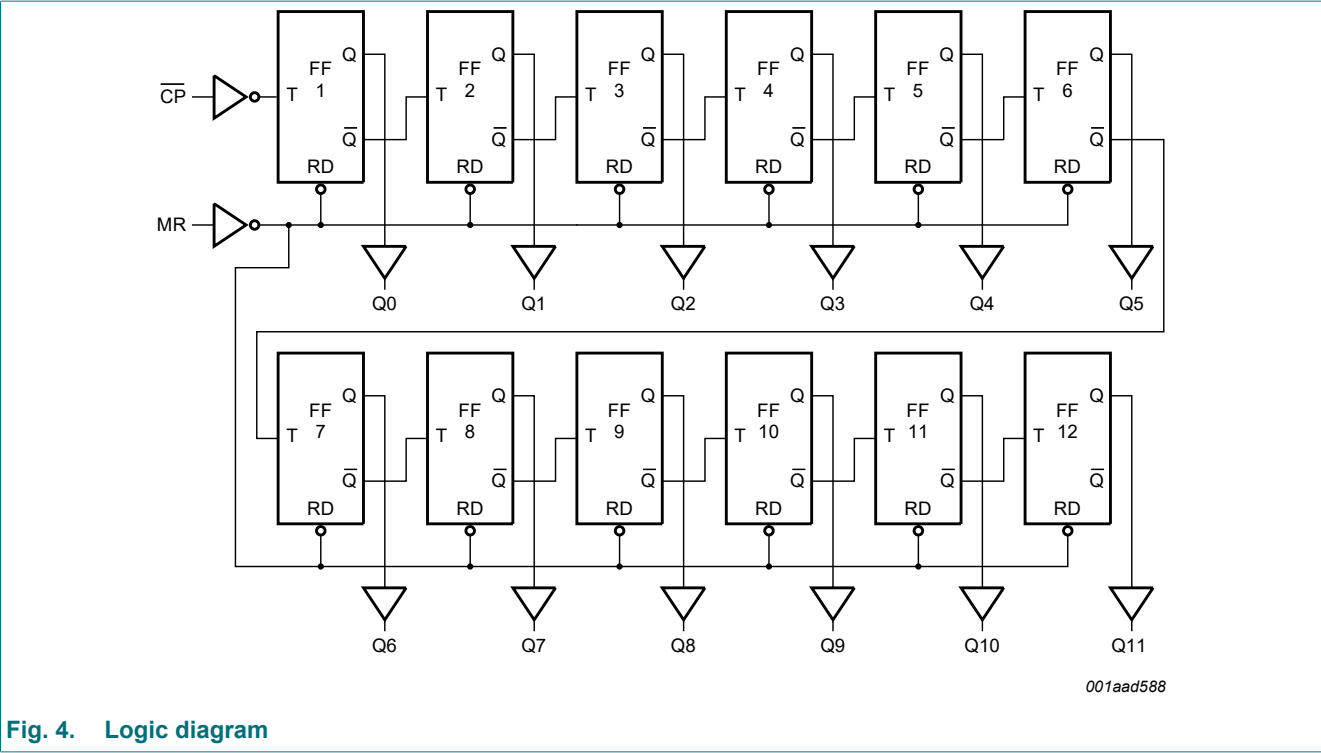
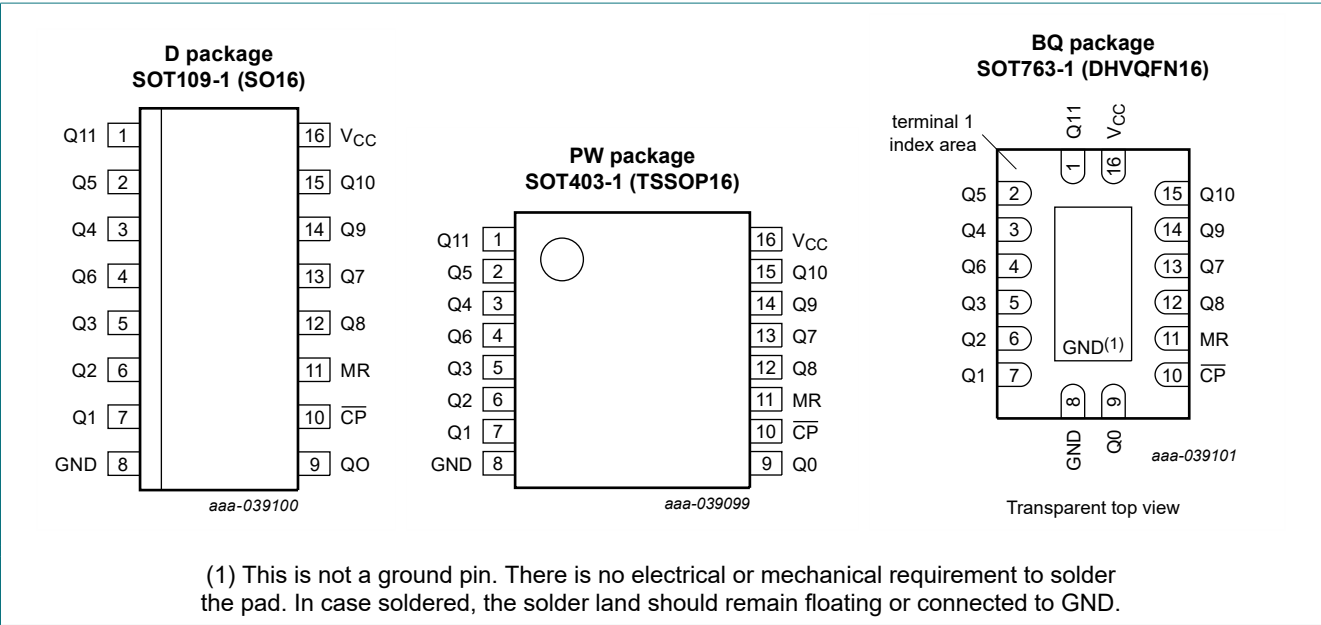


Fig. 4. Logic diagram

6. Pinning information

6.1. Pinning



6.2. Pin description

Table 2. Pin description

| Symbol                 | Pin | Description                               |
|------------------------|-----|-------------------------------------------|
| Q11                    | 1   | output 11                                 |
| Q5                     | 2   | output 5                                  |
| Q4                     | 3   | output 4                                  |
| Q6                     | 4   | output 6                                  |
| Q3                     | 5   | output 3                                  |
| Q2                     | 6   | output 2                                  |
| Q1                     | 7   | output 1                                  |
| GND                    | 8   | ground (0 V)                              |
| Q0                     | 9   | output 0                                  |
| $\overline{\text{CP}}$ | 10  | clock input (HIGH-to-LOW, edge-triggered) |
| MR                     | 11  | master reset input (active HIGH)          |
| Q8                     | 12  | output 8                                  |
| Q7                     | 13  | output 7                                  |
| Q9                     | 14  | output 9                                  |
| Q10                    | 15  | output 10                                 |
| V <sub>CC</sub>        | 16  | positive supply voltage                   |

7. Functional description

7.1. Function table

Table 3. Function table

*H = HIGH voltage level; L = LOW voltage level; X = don't care;*  
*↑ = LOW-to-HIGH clock transition; ↓ = HIGH-to-LOW clock transition.*

| Input |    | Output    |
|-------|----|-----------|
| CP    | MR | Q0 to Q11 |
| ↑     | L  | no change |
| ↓     | L  | count     |
| X     | H  | L         |

7.2. Timing diagram

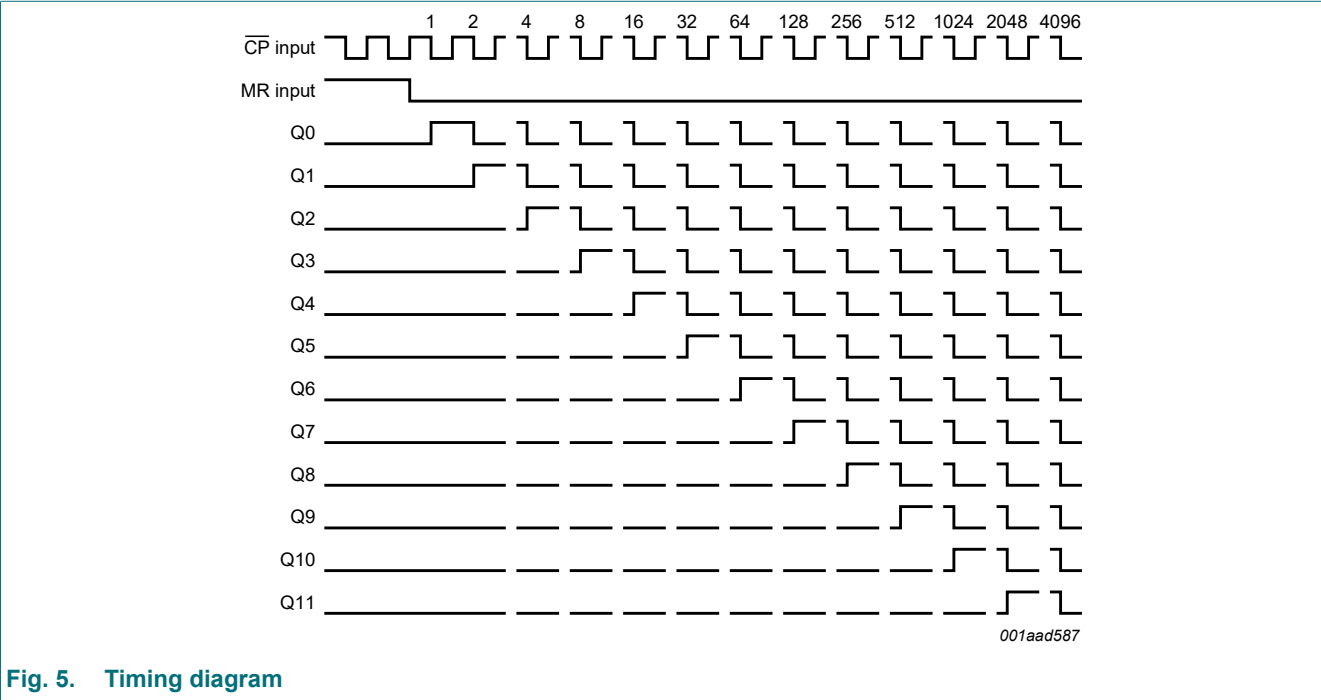


Fig. 5. Timing diagram

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 | $V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$ [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 | $T_{amb} = -40\text{ °C}$ to $+125\text{ °C}$ [2]          | -    | 500  | mW   |

- [1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.  
[2] For SOT109-1 (SO16) package:  $P_{tot}$  derates linearly with 12.4 mW/K above 110 °C.  
For SOT403-1 (TSSOP16) package:  $P_{tot}$  derates linearly with 8.5 mW/K above 91 °C.  
For SOT763-1 (DHVQFN16) package:  $P_{tot}$  derates linearly with 11.2 mW/K above 106 °C.

9. Recommended operating conditions

Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V)

| Symbol           | Parameter                           | Conditions              | 74HC4040-Q100 |      |                 | 74HCT4040-Q100 |      |                 | Unit |
|------------------|-------------------------------------|-------------------------|---------------|------|-----------------|----------------|------|-----------------|------|
|                  |                                     |                         | Min           | Typ  | Max             | Min            | Typ  | Max             |      |
| V <sub>CC</sub>  | supply voltage                      |                         | 2.0           | 5.0  | 6.0             | 4.5            | 5.0  | 5.5             | V    |
| V <sub>I</sub>   | input voltage                       |                         | 0             | -    | V <sub>CC</sub> | 0              | -    | V <sub>CC</sub> | V    |
| V <sub>O</sub>   | output voltage                      |                         | 0             | -    | V <sub>CC</sub> | 0              | -    | V <sub>CC</sub> | V    |
| T <sub>amb</sub> | ambient temperature                 |                         | -40           | +25  | +125            | -40            | +25  | +125            | °C   |
| Δt/ΔV            | input transition rise and fall rate | V <sub>CC</sub> = 2.0 V | -             | -    | 625             | -              | -    | -               | ns/V |
|                  |                                     | V <sub>CC</sub> = 4.5 V | -             | 1.67 | 139             | -              | 1.67 | 139             | ns/V |
|                  |                                     | V <sub>CC</sub> = 6.0 V | -             | -    | 83              | -              | -    | -               | ns/V |

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  |      |
| 74HC4040-Q100   |                           |                                                                                        |       |      |      |                  |      |                   |      |      |
| V <sub>IH</sub> | HIGH-level input voltage  | V <sub>CC</sub> = 2.0 V                                                                | 1.5   | 1.2  | -    | 1.5              | -    | 1.5               | -    | V    |
|                 |                           | V <sub>CC</sub> = 4.5 V                                                                | 3.15  | 2.4  | -    | 3.15             | -    | 3.15              | -    | V    |
|                 |                           | V <sub>CC</sub> = 6.0 V                                                                | 4.2   | 3.2  | -    | 4.2              | -    | 4.2               | -    | V    |
| V <sub>IL</sub> | LOW-level input voltage   | V <sub>CC</sub> = 2.0 V                                                                | -     | 0.8  | 0.5  | -                | 0.5  | -                 | 0.5  | V    |
|                 |                           | V <sub>CC</sub> = 4.5 V                                                                | -     | 2.1  | 1.35 | -                | 1.35 | -                 | 1.35 | V    |
|                 |                           | V <sub>CC</sub> = 6.0 V                                                                | -     | 2.8  | 1.8  | -                | 1.8  | -                 | 1.8  | V    |
| V <sub>OH</sub> | HIGH-level output voltage | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                    |       |      |      |                  |      |                   |      |      |
|                 |                           | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 2.0 V                                       | 1.9   | 2.0  | -    | 1.9              | -    | 1.9               | -    | V    |
|                 |                           | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 4.5 V                                       | 4.4   | 4.5  | -    | 4.4              | -    | 4.4               | -    | V    |
|                 |                           | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 6.0 V                                       | 5.9   | 6.0  | -    | 5.9              | -    | 5.9               | -    | V    |
|                 |                           | I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V                                      | 3.98  | 4.32 | -    | 3.84             | -    | 3.7               | -    | V    |
|                 |                           | I <sub>O</sub> = -5.2 mA; V <sub>CC</sub> = 6.0 V                                      | 5.48  | 5.81 | -    | 5.34             | -    | 5.2               | -    | V    |
| V <sub>OL</sub> | LOW-level output voltage  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                    |       |      |      |                  |      |                   |      |      |
|                 |                           | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 2.0 V                                        | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V                                        | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V                                        | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V                                       | -     | 0.15 | 0.26 | -                | 0.33 | -                 | 0.4  | V    |
|                 |                           | I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V                                       | -     | 0.16 | 0.26 | -                | 0.33 | -                 | 0.4  | V    |
| I <sub>I</sub>  | input leakage current     | V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V                       | -     | -    | ±0.1 | -                | ±1.0 | -                 | ±1.0 | 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> = 6.0 V | -     | -    | 8.0  | -                | 80   | -                 | 160  | μA   |
| C <sub>I</sub>  | input capacitance         |                                                                                        | -     | 3.5  | -    |                  |      |                   |      | pF   |

| Symbol           | Parameter                 | Conditions                                                                                                                                              | 25 °C |      |      | -40 °C to +85 °C |      | -40 °C to +125 °C |      | Unit |
|------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------|------|------------------|------|-------------------|------|------|
|                  |                           |                                                                                                                                                         | Min   | Typ  | Max  | Min              | Max  | Min               | Max  |      |
| 74HCT4040-Q100   |                           |                                                                                                                                                         |       |      |      |                  |      |                   |      |      |
| V <sub>IH</sub>  | HIGH-level input voltage  | V <sub>CC</sub> = 4.5 V to 5.5 V                                                                                                                        | 2.0   | 1.6  | -    | 2.0              | -    | 2.0               | -    | V    |
| V <sub>IL</sub>  | LOW-level input voltage   | V <sub>CC</sub> = 4.5 V to 5.5 V                                                                                                                        | -     | 1.2  | 0.8  | -                | 0.8  | -                 | 0.8  | V    |
| V <sub>OH</sub>  | HIGH-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> = -20 µA                                                                                                                                 | 4.4   | 4.5  | -    | 4.4              | -    | 4.4               | -    | V    |
|                  |                           | I <sub>O</sub> = -4 mA                                                                                                                                  | 3.98  | 4.32 | -    | 3.84             | -    | 3.7               | -    | 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> = 20 µA                                                                                                                                  | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                  |                           | I <sub>O</sub> = 4.0 mA                                                                                                                                 | -     | 0.15 | 0.26 | -                | 0.33 | -                 | 0.4  | V    |
| I <sub>I</sub>   | input leakage current     | V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V                                                                                        | -     | -    | ±0.1 | -                | ±1.0 | -                 | ±1.0 | 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                                                                  | -     | -    | 8.0  | -                | 80   | -                 | 160  | µA   |
| ΔI <sub>CC</sub> | additional supply current | per input pin; V <sub>I</sub> = V <sub>CC</sub> - 2.1 V; I <sub>O</sub> = 0 A; other inputs at V <sub>CC</sub> or GND; V <sub>CC</sub> = 4.5 V to 5.5 V |       |      |      |                  |      |                   |      |      |
|                  |                           | pin $\overline{CP}$                                                                                                                                     | -     | 85   | 306  | -                | 383  | -                 | 417  | µA   |
|                  |                           | pin MR                                                                                                                                                  | -     | 110  | 396  | -                | 495  | -                 | 539  | µA   |
| C <sub>I</sub>   | input capacitance         |                                                                                                                                                         | -     | 3.5  | -    | -                | -    | -                 | -    | pF   |

## 11. Dynamic characteristics

**Table 7. Dynamic characteristics**

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

| Symbol           | Parameter                     | Conditions                                      | 25 °C |     |     | -40 °C to +85 °C |     | -40 °C to +125 °C |     | Unit |
|------------------|-------------------------------|-------------------------------------------------|-------|-----|-----|------------------|-----|-------------------|-----|------|
|                  |                               |                                                 | Min   | Typ | Max | Min              | Max | Min               | Max |      |
| 74HC4040-Q100    |                               |                                                 |       |     |     |                  |     |                   |     |      |
| t <sub>pd</sub>  | propagation delay             | CP to Q0; see Fig. 6 [1]                        |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 2.0 V                         | -     | 47  | 150 | -                | 190 | -                 | 225 | ns   |
|                  |                               | V <sub>CC</sub> = 4.5 V                         | -     | 17  | 30  | -                | 38  | -                 | 45  | ns   |
|                  |                               | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF | -     | 14  | -   | -                | -   | -                 | -   | ns   |
|                  |                               | V <sub>CC</sub> = 6.0 V                         | -     | 14  | 26  | -                | 33  | -                 | 38  | ns   |
|                  |                               | Qn to Qn+1; see Fig. 6                          |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 2.0 V                         | -     | 28  | 100 | -                | 125 | -                 | 150 | ns   |
|                  |                               | V <sub>CC</sub> = 4.5 V                         | -     | 10  | 20  | -                | 25  | -                 | 30  | ns   |
|                  |                               | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF | -     | 8   | -   | -                | -   | -                 | -   | ns   |
|                  |                               | V <sub>CC</sub> = 6.0 V                         | -     | 8   | 17  | -                | 21  | -                 | 26  | ns   |
| t <sub>PHL</sub> | HIGH to LOW propagation delay | MR to Qn; see Fig. 6                            |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 2.0 V                         | -     | 61  | 185 | -                | 230 | -                 | 280 | ns   |
|                  |                               | V <sub>CC</sub> = 4.5 V                         | -     | 22  | 37  | -                | 46  | -                 | 56  | ns   |
|                  |                               | V <sub>CC</sub> = 6.0 V                         | -     | 18  | 31  | -                | 39  | -                 | 48  | ns   |
| t <sub>t</sub>   | transition time               | Qn; see Fig. 6 [2]                              |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 2.0 V                         | -     | 19  | 75  | -                | 95  | -                 | 110 | ns   |
|                  |                               | V <sub>CC</sub> = 4.5 V                         | -     | 7   | 15  | -                | 19  | -                 | 22  | ns   |
|                  |                               | V <sub>CC</sub> = 6.0 V                         | -     | 6   | 13  | -                | 16  | -                 | 19  | ns   |
| t <sub>W</sub>   | pulse width                   | CP input, HIGH or LOW; see Fig. 6               |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 2.0 V                         | 80    | 14  | -   | 100              | -   | 120               | -   | ns   |
|                  |                               | V <sub>CC</sub> = 4.5 V                         | 16    | 5   | -   | 20               | -   | 24                | -   | ns   |
|                  |                               | V <sub>CC</sub> = 6.0 V                         | 14    | 4   | -   | 17               | -   | 20                | -   | ns   |
|                  |                               | MR input, HIGH; see Fig. 6                      |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 2.0 V                         | 80    | 22  | -   | 100              | -   | 120               | -   | ns   |
|                  |                               | V <sub>CC</sub> = 4.5 V                         | 16    | 8   | -   | 20               | -   | 24                | -   | ns   |
|                  |                               | V <sub>CC</sub> = 6.0 V                         | 14    | 6   | -   | 17               | -   | 20                | -   | ns   |
| t <sub>rec</sub> | recovery time                 | MR to CP; see Fig. 6                            |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 2.0 V                         | 50    | 8   | -   | 65               | -   | 75                | -   | ns   |
|                  |                               | V <sub>CC</sub> = 4.5 V                         | 10    | 3   | -   | 13               | -   | 15                | -   | ns   |
|                  |                               | V <sub>CC</sub> = 6.0 V                         | 9     | 2   | -   | 11               | -   | 13                | -   | ns   |
| f <sub>max</sub> | maximum frequency             | CP input; see Fig. 6                            |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 2.0 V                         | 6     | 27  | -   | 4.8              | -   | 4                 | -   | MHz  |
|                  |                               | V <sub>CC</sub> = 4.5 V                         | 30    | 82  | -   | 24               | -   | 20                | -   | MHz  |
|                  |                               | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF | -     | 90  | -   | -                | -   | -                 | -   | MHz  |
|                  |                               | V <sub>CC</sub> = 6.0 V                         | 35    | 98  | -   | 28               | -   | 24                | -   | MHz  |

| Symbol           | Parameter                     | Conditions                                      | 25 °C |     |     | -40 °C to +85 °C |     | -40 °C to +125 °C |     | Unit |
|------------------|-------------------------------|-------------------------------------------------|-------|-----|-----|------------------|-----|-------------------|-----|------|
|                  |                               |                                                 | Min   | Typ | Max | Min              | Max | Min               | Max |      |
| C <sub>PD</sub>  | power dissipation capacitance | V <sub>I</sub> = GND to V <sub>CC</sub> [3]     | -     | 20  | -   | -                | -   | -                 | -   | pF   |
| 74HCT4040-Q100   |                               |                                                 |       |     |     |                  |     |                   |     |      |
| t <sub>pd</sub>  | propagation delay             | $\overline{CP}$ to Q0; see Fig. 6 [1]           |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                         | -     | 19  | 40  | -                | 50  | -                 | 60  | ns   |
|                  |                               | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF | -     | 16  | -   | -                | -   | -                 | -   | ns   |
|                  |                               | Qn to Qn+1; see Fig. 6                          |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                         | -     | 10  | 20  | -                | 25  | -                 | 30  | ns   |
|                  |                               | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF | -     | 8   | -   | -                | -   | -                 | -   | ns   |
| t <sub>PHL</sub> | HIGH to LOW propagation delay | MR to Qn; see Fig. 6                            |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                         | -     | 23  | 45  | -                | 56  | -                 | 68  | ns   |
| t <sub>t</sub>   | transition time               | Qn; see Fig. 6 [2]                              |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                         | -     | 7   | 15  | -                | 19  | -                 | 22  | ns   |
| t <sub>W</sub>   | pulse width                   | $\overline{CP}$ input, HIGH or LOW; see Fig. 6  |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                         | 16    | 7   | -   | 20               | -   | 24                | -   | ns   |
|                  |                               | MR input, HIGH; see Fig. 6                      |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                         | 16    | 6   | -   | 20               | -   | 24                | -   | ns   |
| t <sub>rec</sub> | recovery time                 | MR to $\overline{CP}$ ; see Fig. 6              |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                         | 10    | 2   | -   | 13               | -   | 15                | -   | ns   |
| f <sub>max</sub> | maximum frequency             | $\overline{CP}$ input; see Fig. 6               |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                         | 30    | 72  | -   | 24               | -   | 20                | -   | MHz  |
|                  |                               | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF | -     | 79  | -   | -                | -   | -                 | -   | MHz  |
| C <sub>PD</sub>  | power dissipation capacitance | V <sub>I</sub> = GND to V <sub>CC</sub> [3]     | -     | 20  | -   | -                | -   | -                 | -   | pF   |

[1] t<sub>pd</sub> is the same as t<sub>PHL</sub>, t<sub>PLH</sub>.

[2] t<sub>t</sub> is the same as t<sub>THL</sub>, t<sub>TLH</sub>.

[3] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum (C_L \times V_{CC}^2 \times f_o)$  where:  
f<sub>i</sub> = input frequency in MHz;  
f<sub>o</sub> = output frequency in MHz;  
C<sub>L</sub> = output load capacitance in pF;  
V<sub>CC</sub> = supply voltage in V;  
N = number of inputs switching;  
 $\sum (C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.

11.1. Waveforms and test circuit

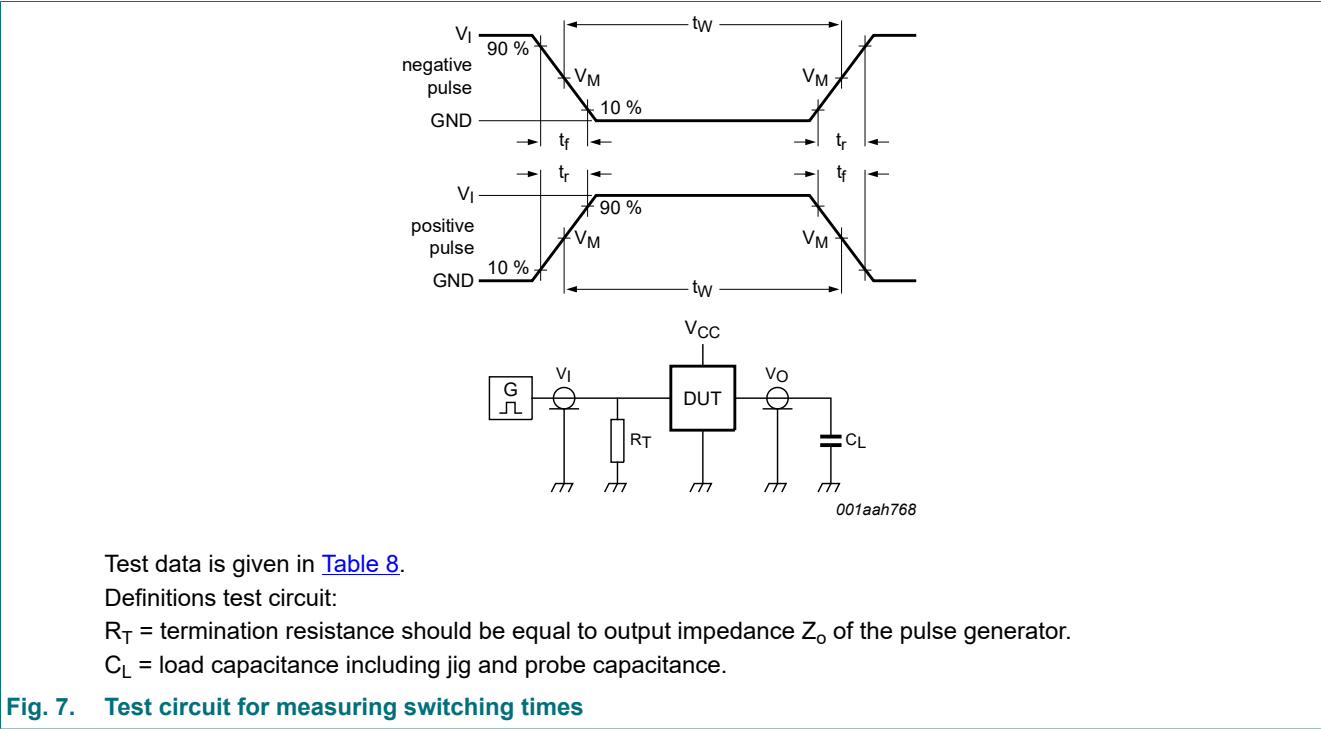
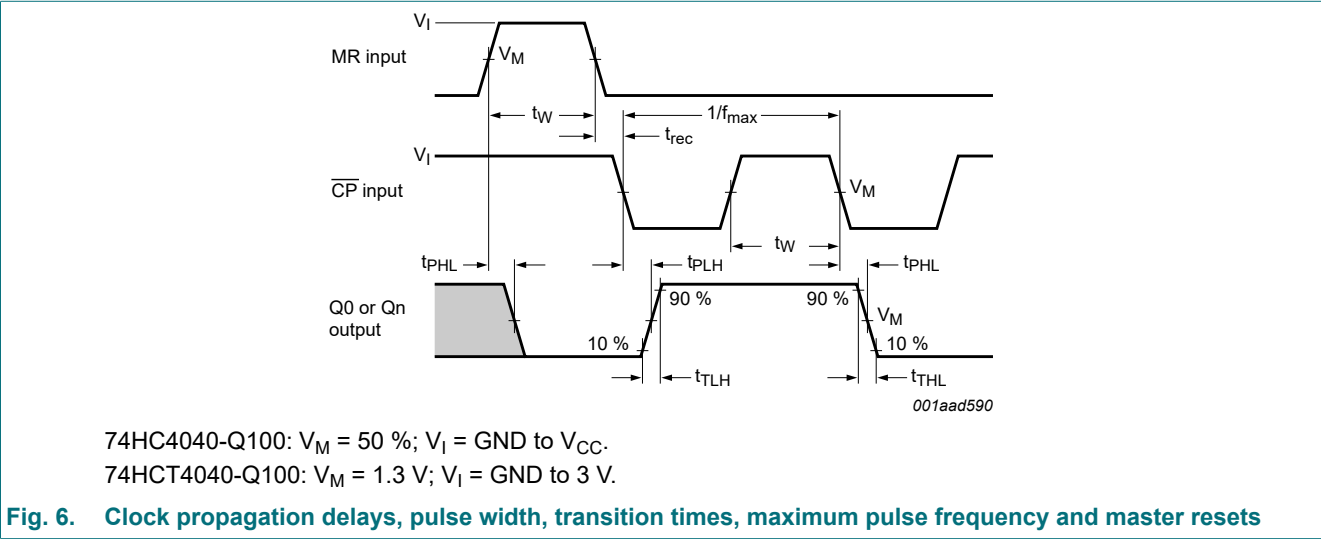


Table 8. Test data

| Type           | Input    |            | Load         | Test               |
|----------------|----------|------------|--------------|--------------------|
|                | $V_I$    | $t_r, t_f$ | $C_L$        |                    |
| 74HC4040-Q100  | $V_{CC}$ | 6.0 ns     | 15 pF, 50 pF | $t_{PLH}, t_{PHL}$ |
| 74HCT4040-Q100 | 3.0 V    | 6.0 ns     | 15 pF, 50 pF | $t_{PLH}, t_{PHL}$ |

12. Package outline

SO16: plastic small outline package; 16 leads; body width 3.9 mm

SOT109-1

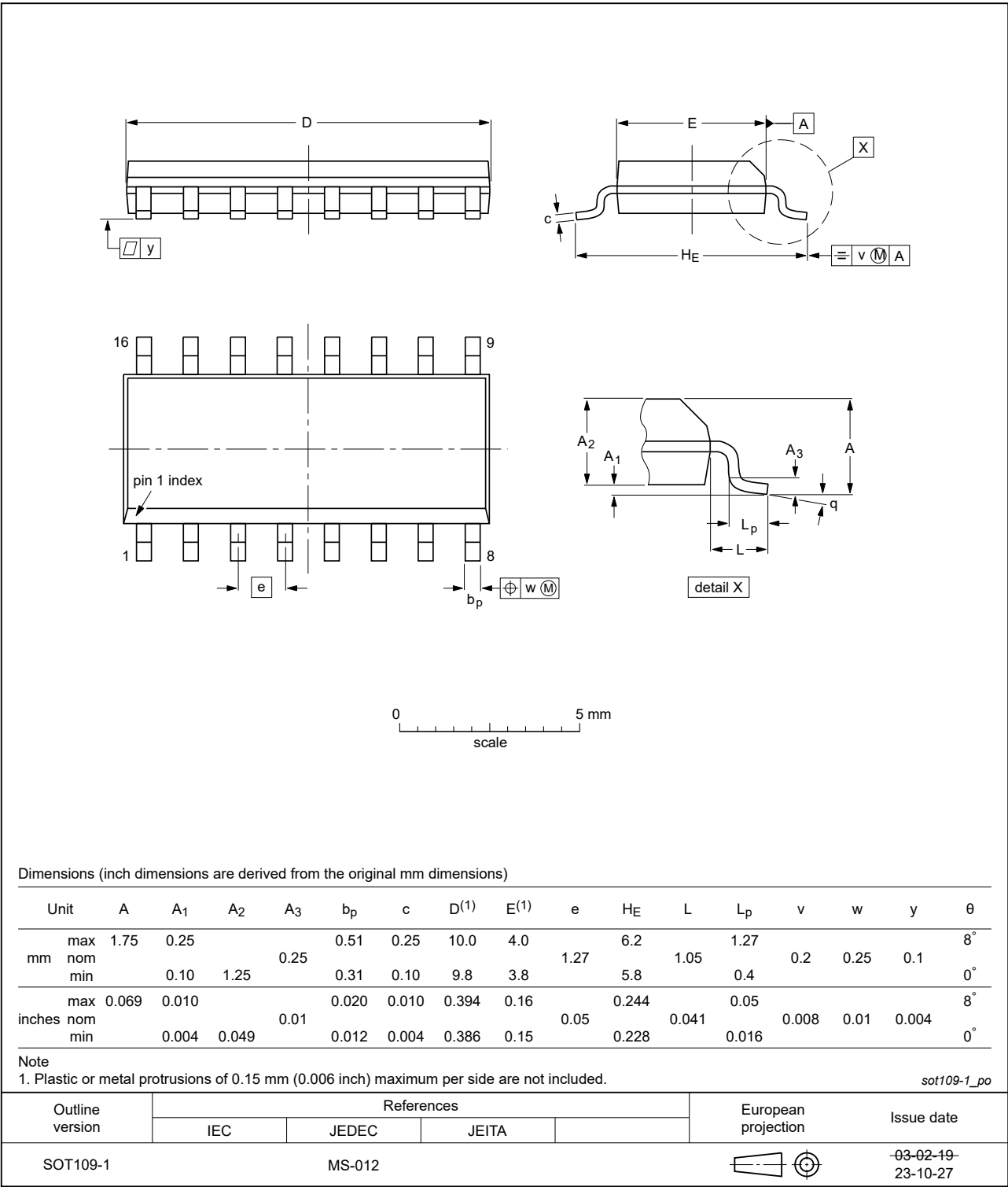


Fig. 8. Package outline SOT109-1 (SO16)

TSSOP16: plastic thin shrink small outline package; 16 leads; body width 4.4 mm

SOT403-1

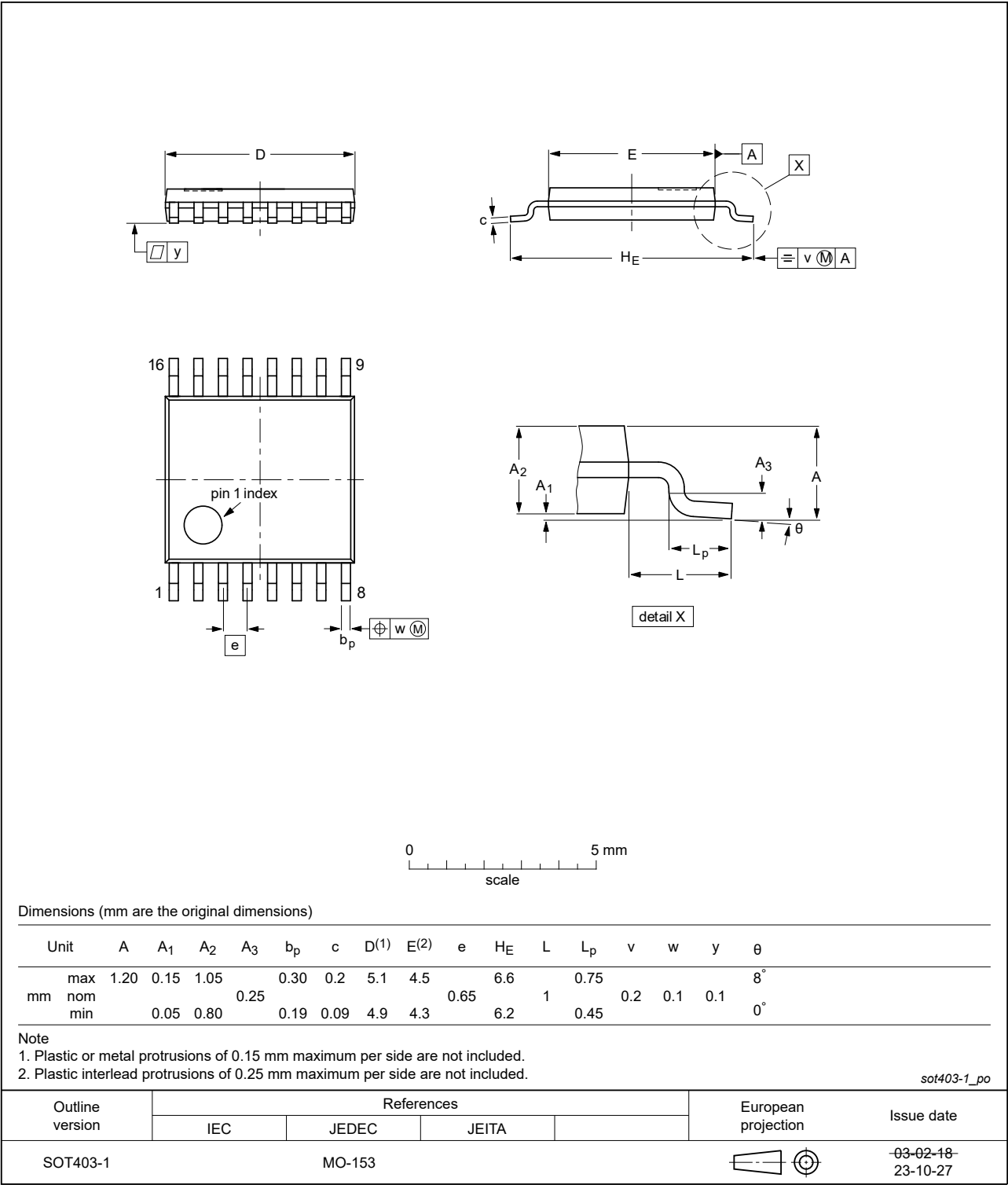


Fig. 9. Package outline SOT403-1 (TSSOP16)

DHVQFN16: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads;  
16 terminals; body 2.5 x 3.5 x 0.85 mm

SOT763-1

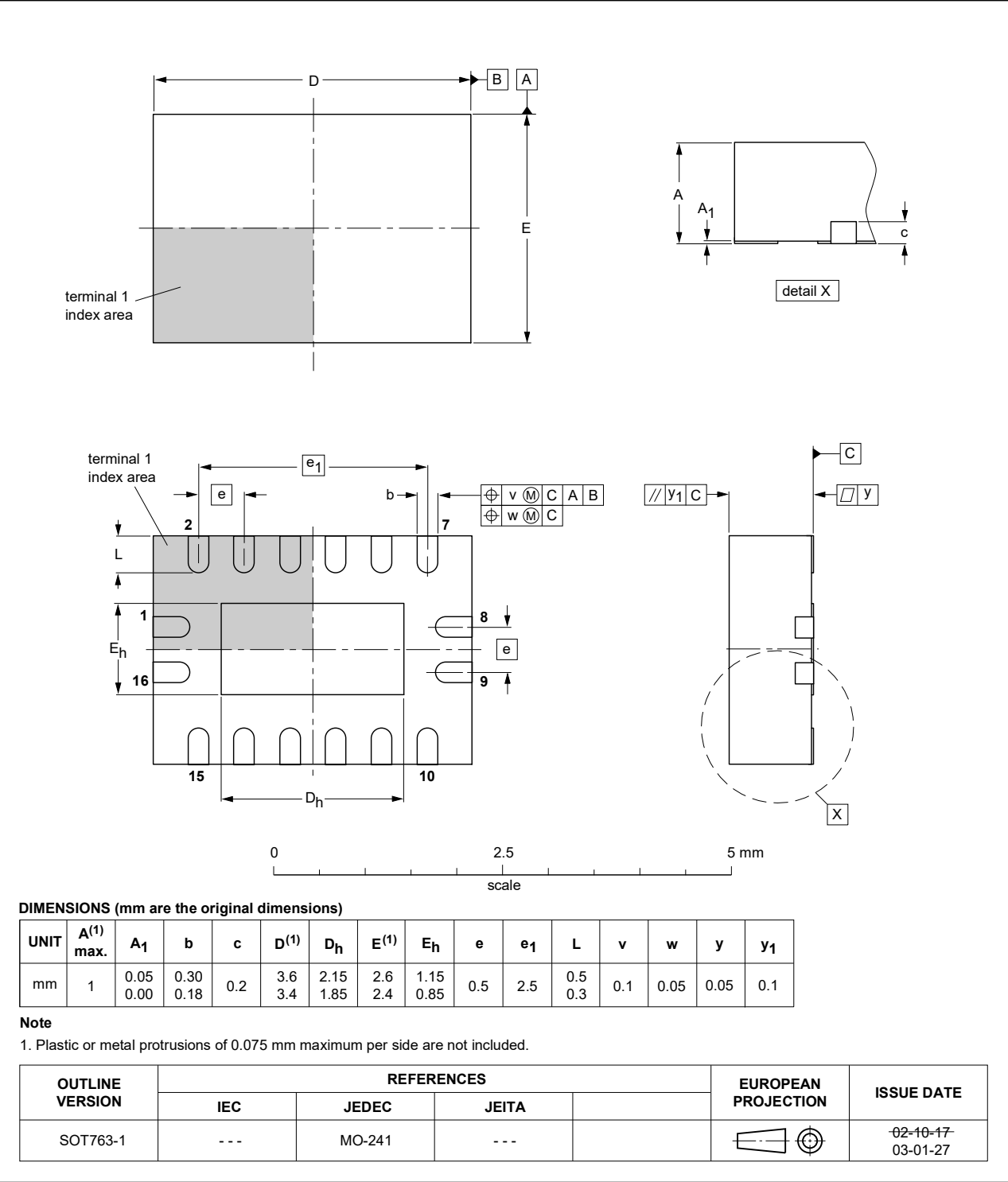


Fig. 10. Package outline SOT763-1 (DHVQFN16)

13. Abbreviations

Table 9. Abbreviations

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

14. Revision history

Table 10. Revision history

| Document ID           | Release date                                                                                                                                                                                                                                                                                                                                                                                                                      | Data sheet status  | Change notice | Supersedes            |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------|-----------------------|
| 74HC_HCT4040_Q100 v.4 | 20240216                                                                                                                                                                                                                                                                                                                                                                                                                          | Product data sheet | -             | 74HC_HCT4040_Q100 v.3 |
| Modifications:        | <ul style="list-style-type: none"><li>Section 2: ESD specification updated according to the latest JEDEC standard.</li><li>Fig. 8 and Fig. 9: Aligned SO and TSSOP package outline drawings to JEDEC MS-012 and MO-153.</li></ul>                                                                                                                                                                                                 |                    |               |                       |
| 74HC_HCT4040_Q100 v.3 | 20210907                                                                                                                                                                                                                                                                                                                                                                                                                          | Product data sheet | -             | 74HC_HCT4040_Q100 v.2 |
| Modifications:        | <ul style="list-style-type: none"><li>Type number 74HC4040DB-Q100 (SOT338-1/SSOP16) removed.</li></ul>                                                                                                                                                                                                                                                                                                                            |                    |               |                       |
| 74HC_HCT4040_Q100 v.2 | 20200608                                                                                                                                                                                                                                                                                                                                                                                                                          | Product data sheet | -             | 74HC_HCT4040_Q100 v.1 |
| Modifications:        | <ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li><li>Legal texts have been adapted to the new company name where appropriate.</li><li>Type number 74HCT4040DB-Q100 (SOT338-1/SSOP16) removed.</li><li>Section 2 updated.</li><li>Table 4: Derating values for P<sub>tot</sub> total power dissipation have been updated.</li></ul> |                    |               |                       |
| 74HC_HCT4040_Q100 v.1 | 20140324                                                                                                                                                                                                                                                                                                                                                                                                                          | 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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