



**THE DATASHEET OF  
74HC4040PW,118**



# 74HC4040; 74HCT4040

## 12-stage binary ripple counter

Rev. 5 — 3 February 2016

Product data sheet

### 1. General description

The 74HC4040; 74HCT4040 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 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  $V_{CC}$ .

### 2. Features and benefits

- Complies with JEDEC standard no. 7A
- Input levels:
  - ◆ For 74HC4040: CMOS level
  - ◆ For 74HCT4040: TTL level
- ESD protection:
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  and from  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$

### 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  |
| 74HC4040D   | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SO16   | plastic small outline package; 16 leads; body width 3.9 mm        | SOT109-1 |
| 74HCT4040D  |   |        |   |          |
| 74HC4040DB  | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SSOP16 | plastic shrink small outline package; 16 leads; body width 5.3 mm | SOT338-1 |
| 74HCT4040DB |   |        |   |          |

Table 1. Ordering information ...continued

| Type number | Package           |          |  | Version  |
|-------------|-------------------|----------|--|----------|
|             | Temperature range | Name     | Description  |          |
| 74HC4040PW  | -40 °C to +125 °C | TSSOP16  | plastic thin shrink small outline package; 16 leads; body width 4.4 mm   | SOT403-1 |
| 74HCT4040PW |                   |          |  |          |
| 74HC4040BQ  | -40 °C to +125 °C | DHVQFN16 | plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 × 3.5 × 0.85 mm | SOT763-1 |
| 74HCT4040BQ |                   |          |  |          |

## 5. Functional diagram

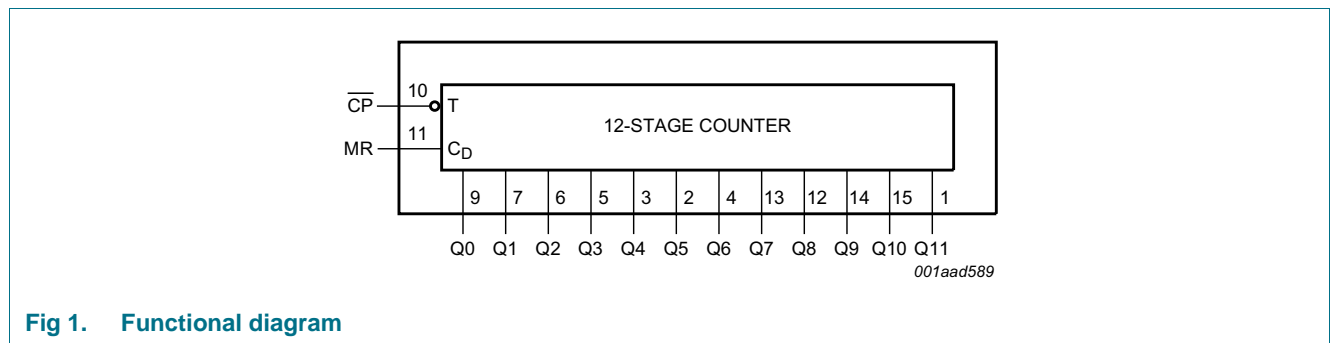


Fig 1. Functional diagram

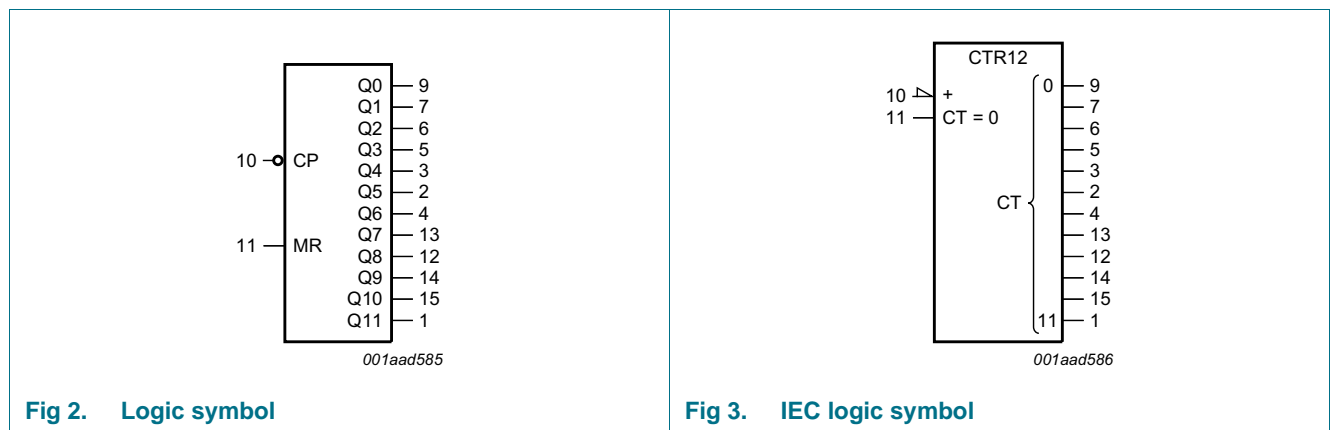


Fig 2. Logic symbol

Fig 3. IEC logic symbol

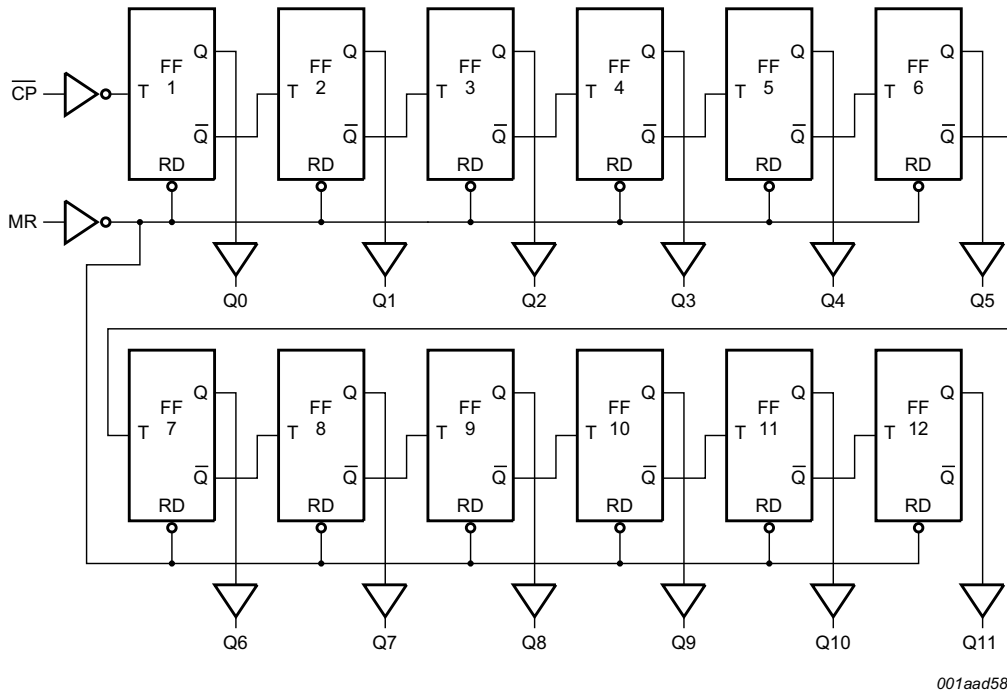


Fig 4. Logic diagram

## 6. Pinning information

### 6.1 Pinning

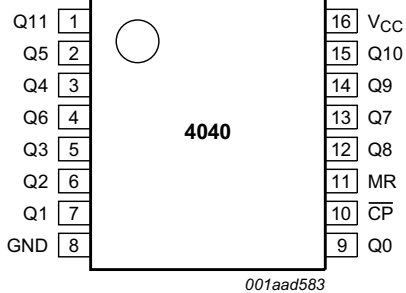
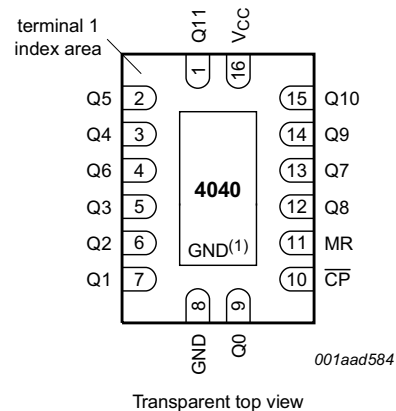


Fig 5. Pin configuration SO16, SSOP16 and TSSOP16



- (1) This is not a supply pin. The substrate is attached to this pad using conductive die attach material. There is no electrical or mechanical requirement to solder this pad. However, if it is soldered, the solder land should remain floating or be connected to GND.

Fig 6. Pin configuration DHVQFN16

## 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

| Input                  |    | Output    |
|------------------------|----|-----------|
| $\overline{\text{CP}}$ | MR | Q0 to Q11 |
| ↑                      | L  | no change |
| ↓                      | L  | count     |
| X                      | H  | L         |

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

## 7.2 Timing diagram

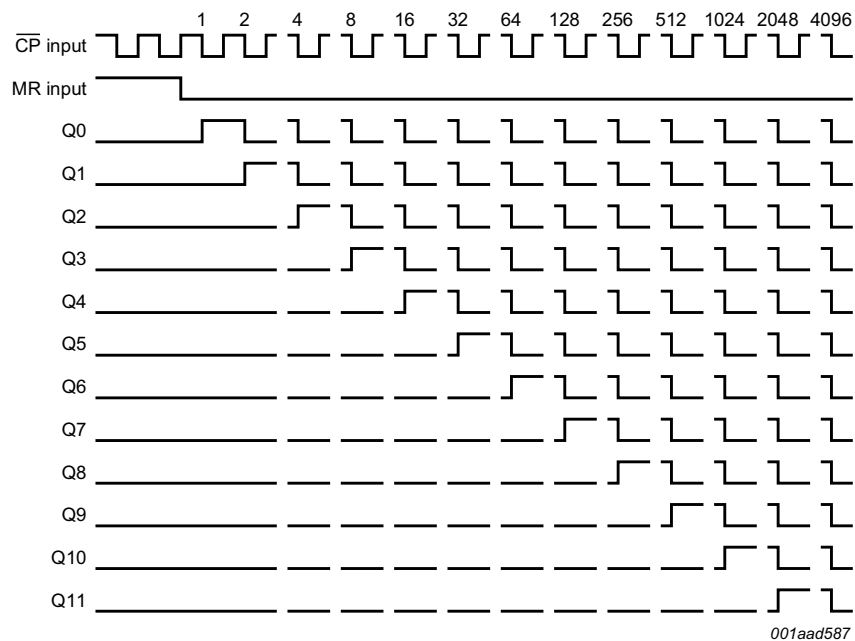


Fig 7. Timing diagram

## 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] | -    | $\pm 20$ | mA   |
| $I_{OK}$  | output clamping current | $V_I < -0.5 \text{ V}$ or $V_I > V_{CC} + 0.5 \text{ V}$ [1] | -    | $\pm 20$ | mA   |
| $I_O$     | output current          | $-0.5 \text{ V} < V_O < V_{CC} + 0.5 \text{ V}$              | -    | $\pm 25$ | mA   |
| $I_{CC}$  | supply current          |  | -    | $\pm 50$ | mA   |
| $I_{GND}$ | ground current          |  | -    | $\pm 50$ | mA   |
| $T_{stg}$ | storage temperature     |  | -65  | +150     | °C   |
| $P_{tot}$ | total power dissipation | $T_{amb} = -40 \text{ °C}$ to $+125 \text{ °C}$ [2]          | -    |          |      |
|           |                         | SO16, SSOP16, TSSOP16 and DHVQFN16 packages                  | -    | 500      | mW   |

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

[2] For SO16 package:  $P_{tot}$  derates linearly with 8 mW/K above 70 °C.

For SSOP16 and TSSOP16 packages:  $P_{tot}$  derates linearly with 5.5 mW/K above 60 °C.

For DHVQFN16 packages:  $P_{tot}$  derates linearly with 4.5 mW/K above 60 °C.

## 9. Recommended operating conditions

**Table 5. Recommended operating conditions**

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

| Symbol              | Parameter                           | Conditions              | 74HC4040 |      |          | 74HCT4040 |      |          | 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 |

## 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       |               |
| <b>74HC4040</b> |                           |  |       |      |           |                  |           |                   |           |               |
| $V_{IH}$        | HIGH-level input voltage  | $V_{CC} = 2.0\text{ V}$  | 1.5   | 1.2  | -         | 1.5              | -         | 1.5               | -         | V             |
|                 |                           | $V_{CC} = 4.5\text{ V}$  | 3.15  | 2.4  | -         | 3.15             | -         | 3.15              | -         | V             |
|                 |                           | $V_{CC} = 6.0\text{ V}$  | 4.2   | 3.2  | -         | 4.2              | -         | 4.2               | -         | V             |
| $V_{IL}$        | LOW-level input voltage   | $V_{CC} = 2.0\text{ V}$  | -     | 0.8  | 0.5       | -                | 0.5       | -                 | 0.5       | V             |
|                 |                           | $V_{CC} = 4.5\text{ V}$  | -     | 2.1  | 1.35      | -                | 1.35      | -                 | 1.35      | V             |
|                 |                           | $V_{CC} = 6.0\text{ V}$  | -     | 2.8  | 1.8       | -                | 1.8       | -                 | 1.8       | V             |
| $V_{OH}$        | HIGH-level output voltage | $V_I = V_{IH}$ or $V_{IL}$   |       |      |           |                  |           |                   |           |               |
|                 |                           | $I_O = -20\text{ }\mu\text{A}$ ; $V_{CC} = 2.0\text{ V}$               | 1.9   | 2.0  | -         | 1.9              | -         | 1.9               | -         | V             |
|                 |                           | $I_O = -20\text{ }\mu\text{A}$ ; $V_{CC} = 4.5\text{ V}$               | 4.4   | 4.5  | -         | 4.4              | -         | 4.4               | -         | V             |
|                 |                           | $I_O = -20\text{ }\mu\text{A}$ ; $V_{CC} = 6.0\text{ V}$               | 5.9   | 6.0  | -         | 5.9              | -         | 5.9               | -         | V             |
|                 |                           | $I_O = -4.0\text{ mA}$ ; $V_{CC} = 4.5\text{ V}$                       | 3.98  | 4.32 | -         | 3.84             | -         | 3.7               | -         | V             |
| $V_{OL}$        | LOW-level output voltage  | $V_I = V_{IH}$ or $V_{IL}$   |       |      |           |                  |           |                   |           |               |
|                 |                           | $I_O = 20\text{ }\mu\text{A}$ ; $V_{CC} = 2.0\text{ V}$                | -     | 0    | 0.1       | -                | 0.1       | -                 | 0.1       | V             |
|                 |                           | $I_O = 20\text{ }\mu\text{A}$ ; $V_{CC} = 4.5\text{ V}$                | -     | 0    | 0.1       | -                | 0.1       | -                 | 0.1       | V             |
|                 |                           | $I_O = 20\text{ }\mu\text{A}$ ; $V_{CC} = 6.0\text{ V}$                | -     | 0    | 0.1       | -                | 0.1       | -                 | 0.1       | V             |
|                 |                           | $I_O = 4.0\text{ mA}$ ; $V_{CC} = 4.5\text{ V}$                        | -     | 0.15 | 0.26      | -                | 0.33      | -                 | 0.4       | V             |
| $I_I$           | input leakage current     | $V_I = V_{CC}$ or GND;<br>$V_{CC} = 6.0\text{ V}$                      | -     | -    | $\pm 0.1$ | -                | $\pm 1.0$ | -                 | $\pm 1.0$ | $\mu\text{A}$ |
|                 |                           | $V_I = V_{CC}$ or GND; $I_O = 0\text{ A}$ ;<br>$V_{CC} = 6.0\text{ V}$ | -     | -    | 8.0       | -                | 80        | -                 | 160       | $\mu\text{A}$ |

**Table 6. Static characteristics ...continued**

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  |      |
| C <sub>I</sub>   | input capacitance         |  | -     | 3.5  | -    |                  |      |                   |      | pF   |
| <b>74HCT4040</b> |                           |  |       |      |      |                  |      |                   |      |      |
| 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;<br>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;<br>V <sub>CC</sub> = 5.5 V  | -     | -    | 8.0  | -                | 80   | -                 | 160  | μA   |
| ΔI <sub>CC</sub> | additional supply current | per input pin;<br>V <sub>I</sub> = V <sub>CC</sub> − 2.1 V; I <sub>O</sub> = 0 A;<br>other inputs at V <sub>CC</sub> or GND;<br>V <sub>CC</sub> = 4.5 V to 5.5 V |       |      |      |                  |      |                   |      |      |
|                  |                           | pin 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 [Figure 9](#).

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

**Table 7. Dynamic characteristics ...continued**GND (ground = 0 V);  $C_L = 50$  pF unless otherwise specified; for test circuit, see [Figure 9](#).

| Symbol           | Parameter                     | Conditions   | 25 °C |     |     | −40 °C to +85 °C |     | −40 °C to +125 °C |     | Unit |
|------------------|-------------------------------|--|-------|-----|-----|------------------|-----|-------------------|-----|------|
|                  |                               |  | Min   | Typ | Max | Min              | Max | Min               | Max |      |
| $C_{PD}$         | power dissipation capacitance | $V_I = \text{GND to } V_{CC}$ [3]                                | -     | 20  | -   | -                | -   | -                 | -   | pF   |
| <b>74HCT4040</b> |                               |  |       |     |     |                  |     |                   |     |      |
| $t_{pd}$         | propagation delay             | $\overline{CP}$ to Q0; see <a href="#">Figure 8</a> [1]          | -     |     |     |                  |     |                   |     |      |
|                  |                               | $V_{CC} = 4.5$ V   | -     | 19  | 40  | -                | 50  | -                 | 60  | ns   |
|                  |                               | $V_{CC} = 5.0$ V; $C_L = 15$ pF                                  | -     | 16  | -   | -                | -   | -                 | -   | ns   |
|                  |                               | Qn to Qn+1; see <a href="#">Figure 8</a>                         |       |     |     |                  |     |                   |     |      |
|                  |                               | $V_{CC} = 4.5$ V   | -     | 10  | 20  | -                | 25  | -                 | 30  | ns   |
|                  |                               | $V_{CC} = 5.0$ V; $C_L = 15$ pF                                  | -     | 8   | -   | -                | -   | -                 | -   | ns   |
| $t_{PHL}$        | HIGH to LOW propagation delay | MR to Qn; see <a href="#">Figure 8</a>                           |       |     |     |                  |     |                   |     |      |
|                  |                               | $V_{CC} = 4.5$ V   | -     | 23  | 45  | -                | 56  | -                 | 68  | ns   |
| $t_t$            | transition time               | Qn; see <a href="#">Figure 8</a> [2]                             |       |     |     |                  |     |                   |     |      |
|                  |                               | $V_{CC} = 4.5$ V   | -     | 7   | 15  | -                | 19  | -                 | 22  | ns   |
| $t_W$            | pulse width                   | $\overline{CP}$ input, HIGH or LOW; see <a href="#">Figure 8</a> |       |     |     |                  |     |                   |     |      |
|                  |                               | $V_{CC} = 4.5$ V   | 16    | 7   | -   | 20               | -   | 24                | -   | ns   |
|                  |                               | MR input, HIGH; see <a href="#">Figure 8</a>                     |       |     |     |                  |     |                   |     |      |
|                  |                               | $V_{CC} = 4.5$ V   | 16    | 6   | -   | 20               | -   | 24                | -   | ns   |
| $t_{rec}$        | recovery time                 | MR to $\overline{CP}$ ; see <a href="#">Figure 8</a>             |       |     |     |                  |     |                   |     |      |
|                  |                               | $V_{CC} = 4.5$ V   | 10    | 2   | -   | 13               | -   | 15                | -   | ns   |
| $f_{max}$        | maximum frequency             | $\overline{CP}$ input; see <a href="#">Figure 8</a>              |       |     |     |                  |     |                   |     |      |
|                  |                               | $V_{CC} = 4.5$ V   | 30    | 72  | -   | 24               | -   | 20                | -   | MHz  |
|                  |                               | $V_{CC} = 5.0$ V; $C_L = 15$ pF                                  | -     | 79  | -   | -                | -   | -                 | -   | MHz  |
| $C_{PD}$         | power dissipation capacitance | $V_I = \text{GND to } V_{CC}$ [3]                                | -     | 20  | -   | -                | -   | -                 | -   | pF   |

[1]  $t_{pd}$  is the same as  $t_{PHL}$ ,  $t_{PLH}$ .[2]  $t_t$  is the same as  $t_{THL}$ ,  $t_{TLH}$ .[3]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ).

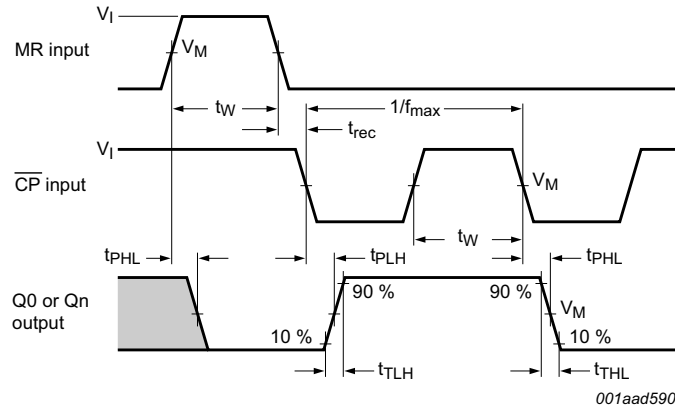
$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

 $f_i$  = 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;

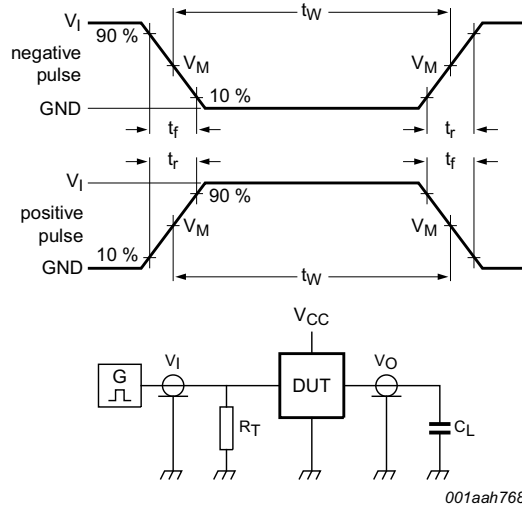
 $\sum(C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.

## 12. Waveform and test circuit



74HC4040:  $V_M = 50\%$ ;  $V_I = \text{GND to } V_{CC}$ .  
 74HCT4040:  $V_M = 1.3 \text{ V}$ ;  $V_I = \text{GND to } 3 \text{ V}$ .

**Fig 8. Clock propagation delays, pulse width, transition times, maximum pulse frequency and master resets**



Test data is given in [Table 8](#).

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.

**Fig 9. Test circuit for measuring switching times**

**Table 8. Test data**

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

13. Package outline

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

SOT109-1

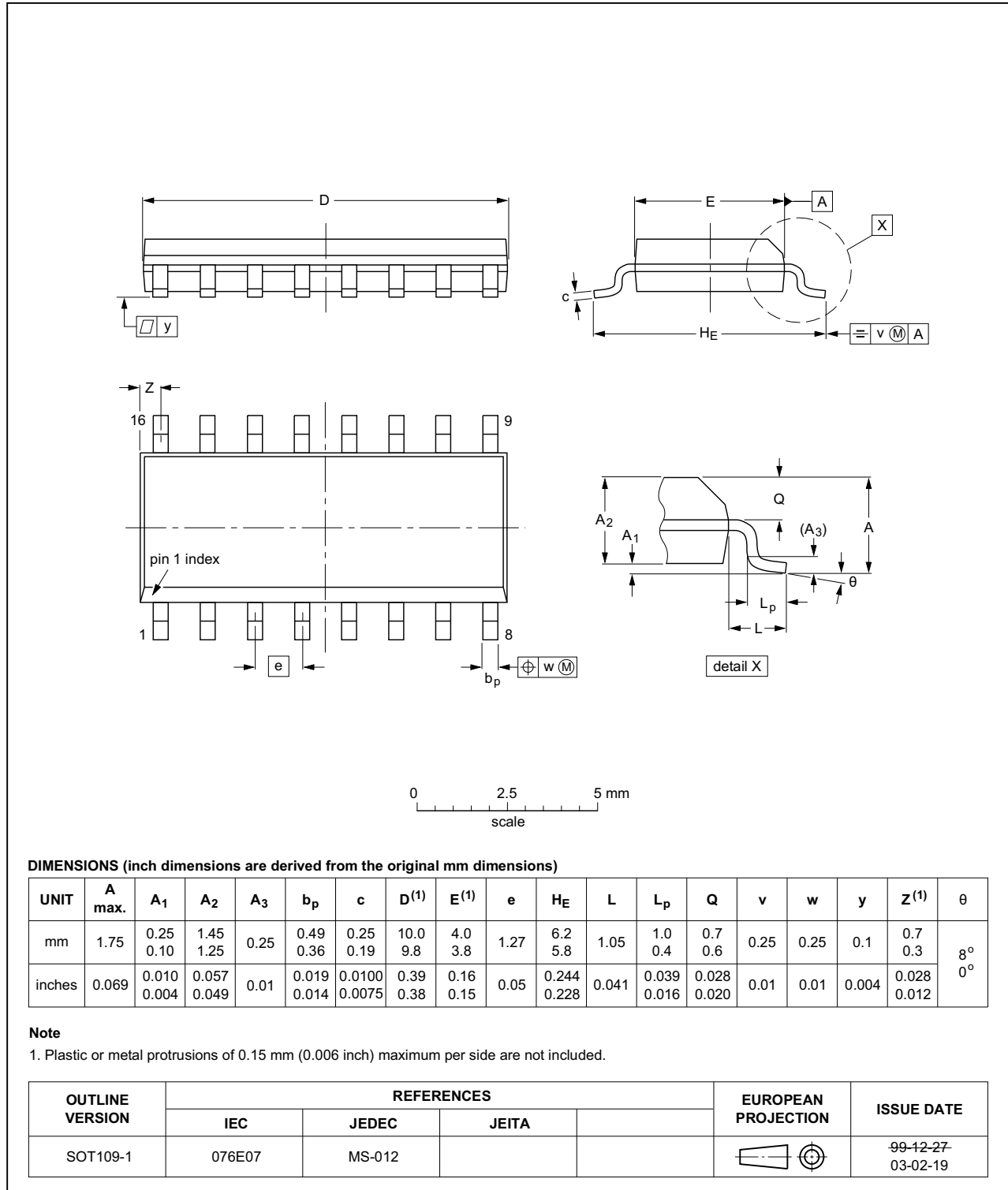


Fig 10. Package outline SOT109-1 (SO16)

SSOP16: plastic shrink small outline package; 16 leads; body width 5.3 mm

SOT338-1

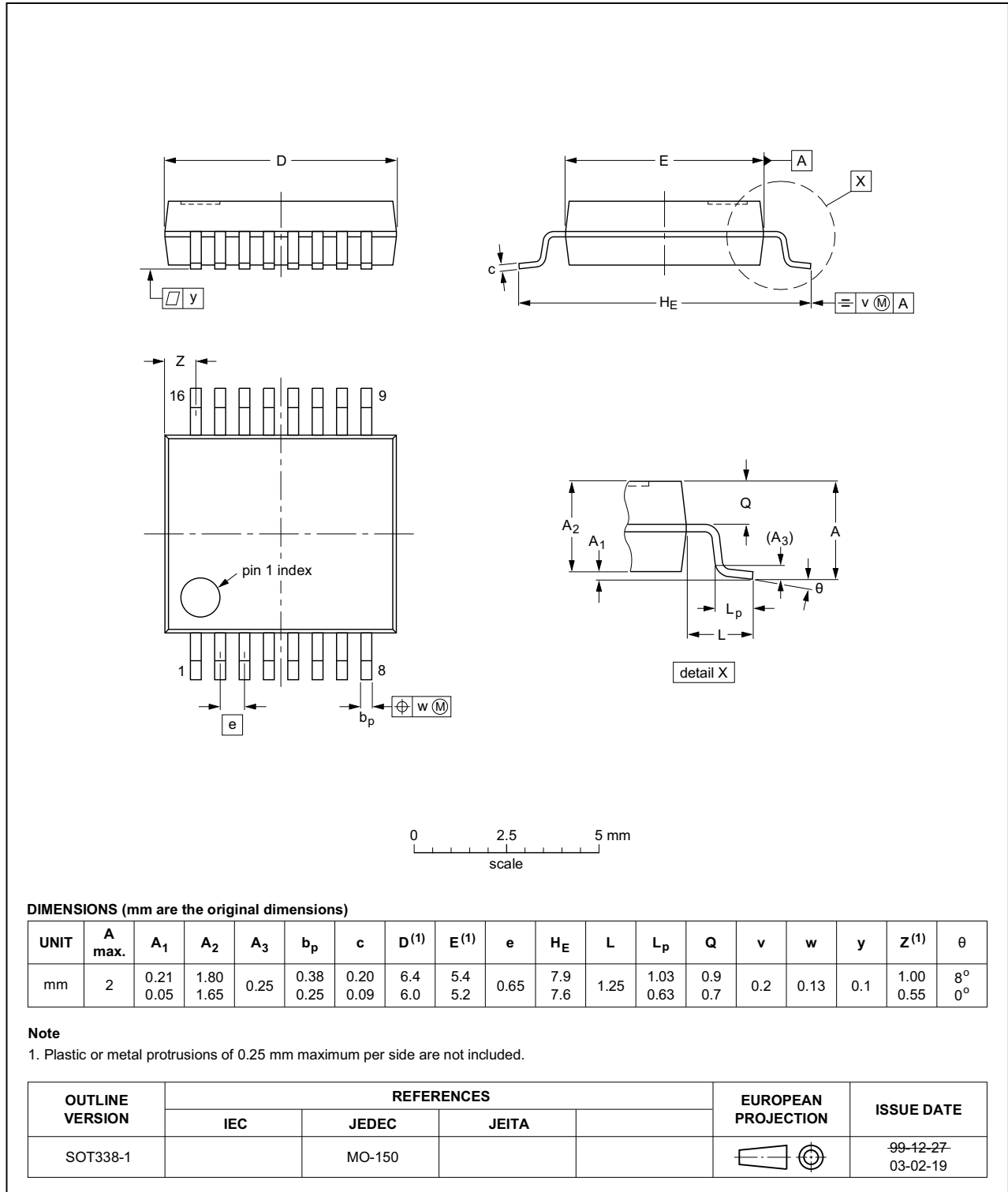


Fig 11. Package outline SOT338-1 (SSOP16)

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

SOT403-1

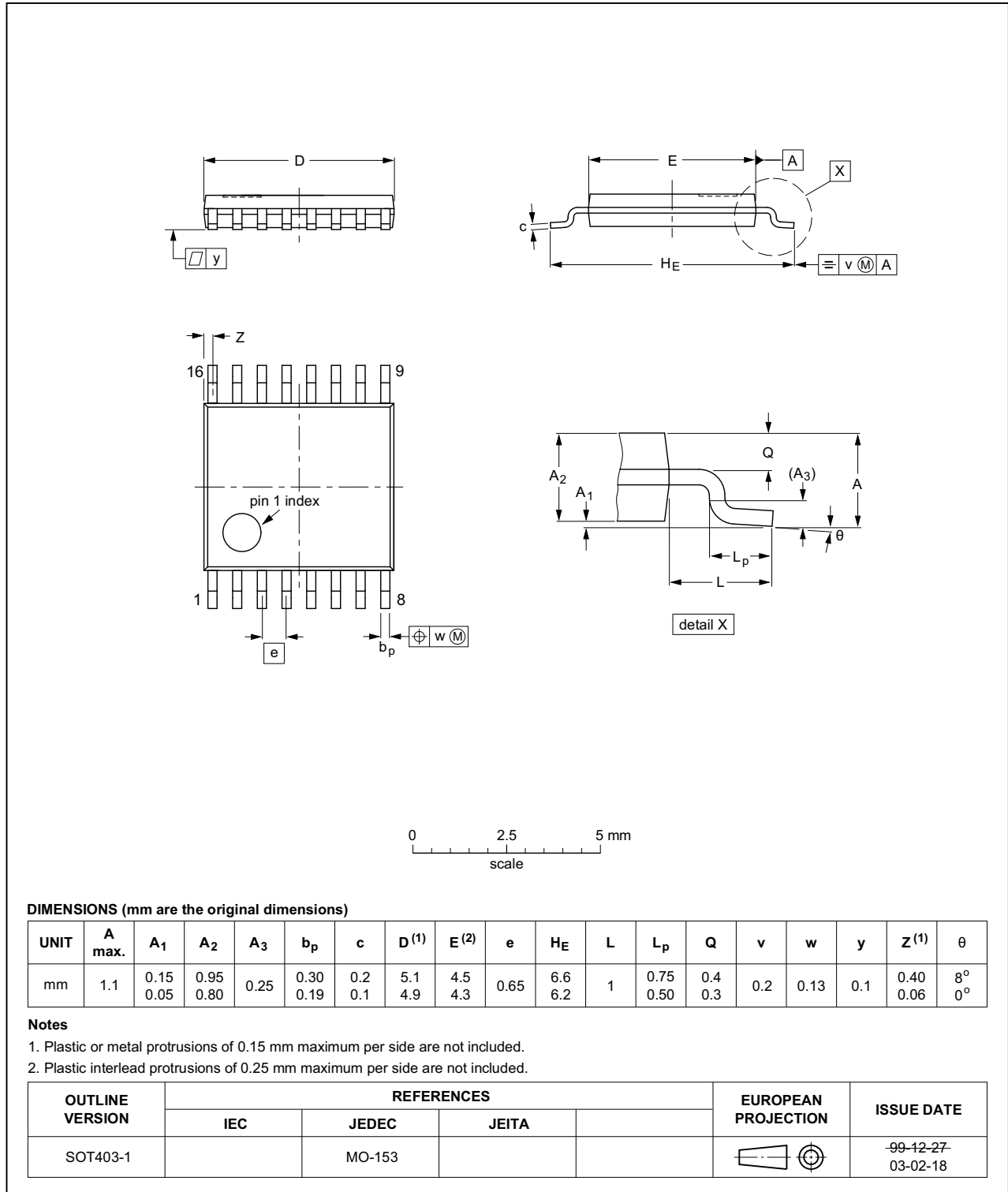
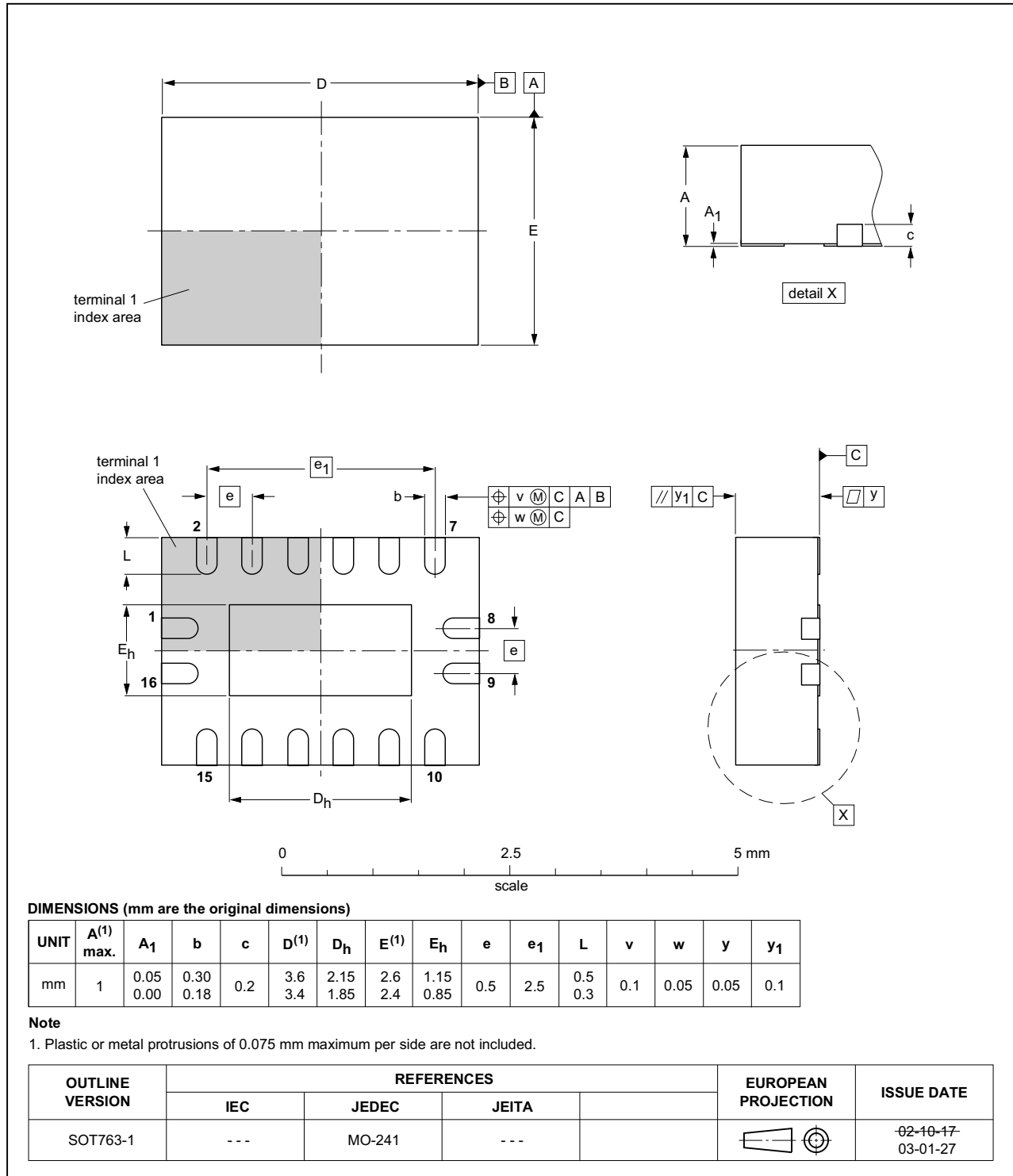


Fig 12. Package outline SOT403-1 (TSSOP16)

**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 13. Package outline SOT763-1 (DHVQFN16)**

## 14. Abbreviations

Table 9. Abbreviations

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

## 15. Revision history

Table 10. Revision history

| Document ID          | Release date  | Data sheet status     | Change notice | Supersedes           |
|----------------------|---|-----------------------|---------------|----------------------|
| 74HC_HCT4040 v.5     | 20160203  | Product data sheet    | -             | 74HC_HCT4040 v.4     |
| Modifications:       | <ul style="list-style-type: none"> <li>Type numbers 74HC4040N and 74HCT4040N (SOT38-4) removed.</li> </ul>  |                       |               |                      |
| 74HC_HCT4040 v.4     | 20140320  | Product data sheet    | -             | 74HC_HCT4040 v.3     |
| Modifications:       | <ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> </ul> |                       |               |                      |
| 74HC_HCT4040 v.3     | 20050914  | Product data sheet    | -             | 74HC_HCT4040_CNV v.2 |
| 74HC_HCT4040_CNV v.2 | 19901231  | Product specification | -             | -                    |

## 16. Legal information

### 16.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | Definition  |
|-----------------------------------|-------------------------------|---|
| Objective [short] data sheet      | Development                   | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet    | Qualification                 | This document contains data from the preliminary specification.                       |
| Product [short] data sheet        | Production                    | This document contains the product specification.                                     |

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[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 URL <http://www.nexperia.com>.

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