

# 74HC175; 74HCT175

Quad D-type flip-flop with reset; positive-edge trigger

Rev. 5 — 29 January 2016

Product data sheet

## 1. General description

The 74HC175; 74HCT175 is a quad positive-edge triggered D-type flip-flop with individual data inputs ( $D_n$ ) and complementary outputs ( $Q_n$  and  $\overline{Q_n}$ ). The common clock (CP) and master reset ( $\overline{MR}$ ) inputs load and reset all flip-flops simultaneously. The D-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 Q output. A LOW on  $\overline{MR}$  causes the flip-flops and outputs to be reset LOW. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ .

## 2. Features and benefits

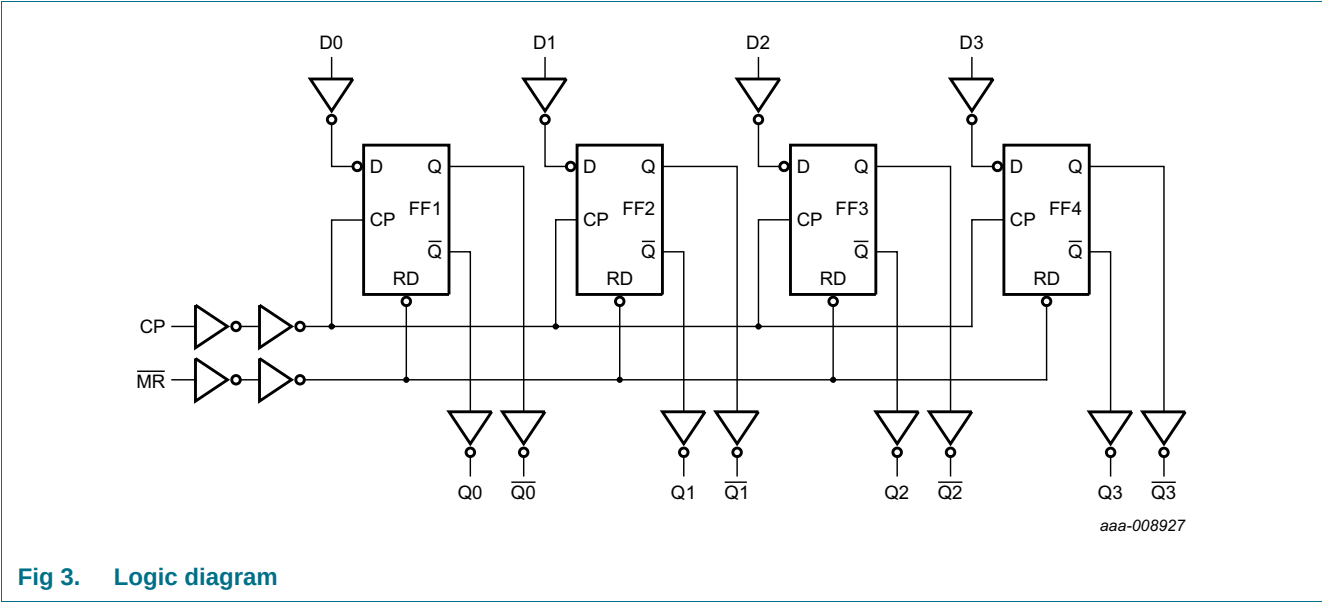
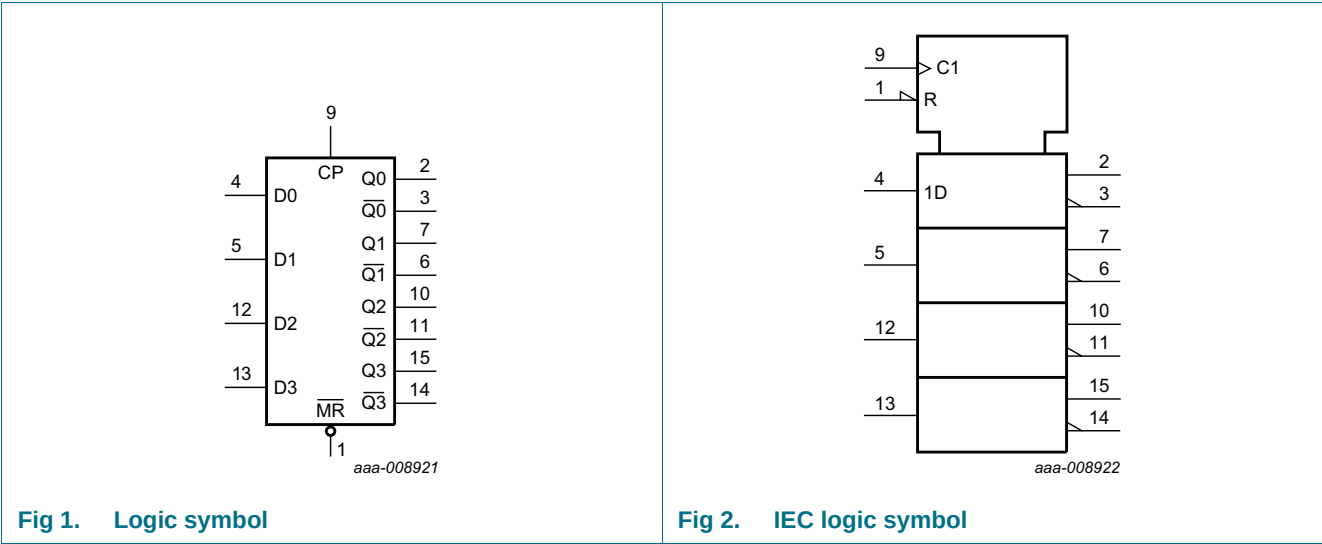
- Input levels:
  - ◆ For 74HC175: CMOS level
  - ◆ For 74HCT175: TTL level
- Four edge-triggered D-type flip-flops
- Asynchronous master reset
- Complies with JEDEC standard no. 7A
- ESD protection:
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V.
- Multiple package options
- Specified from  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  and  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$ .

## 3. Ordering information

Table 1. Ordering information

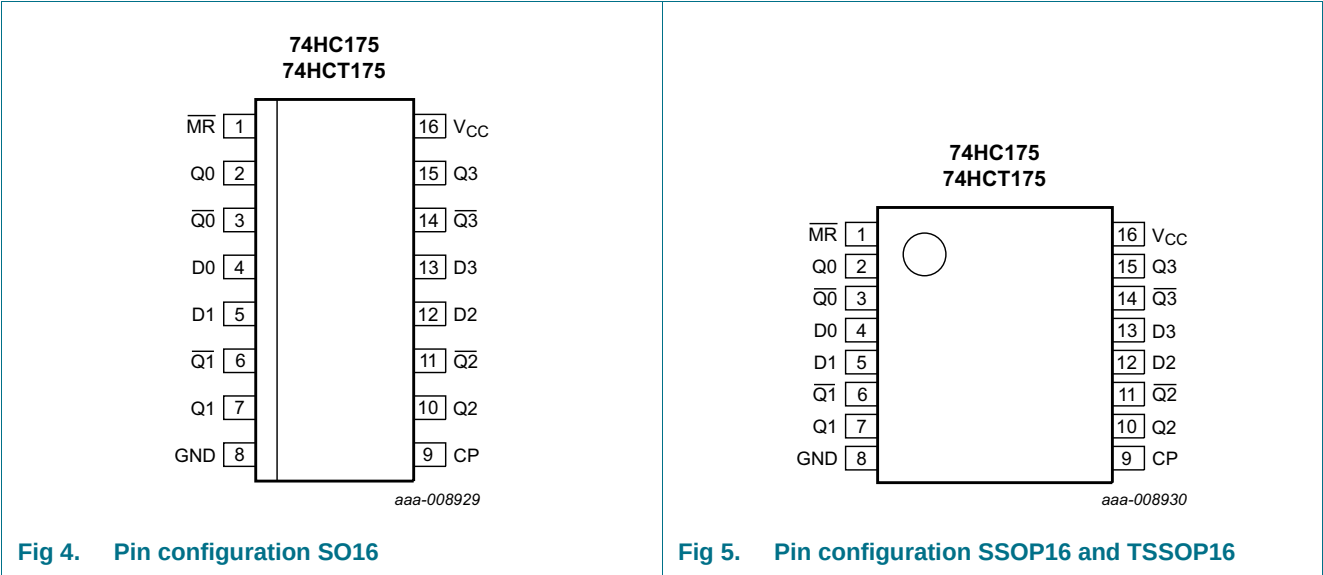
| Type number | Package                                                         |         |                                                                        |          |
|-------------|-----------------------------------------------------------------|---------|------------------------------------------------------------------------|----------|
|             | Temperature range                                               | Name    | Description                                                            | Version  |
| 74HC175D    | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SO16    | plastic small outline package; 16 leads; body width 3.9 mm             | SOT109-1 |
| 74HCT175D   |                                                                 |         |                                                                        |          |
| 74HC175DB   | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SSOP16  | plastic shrink small outline package; 16 leads; body width 5.3 mm      | SOT338-1 |
| 74HCT175DB  |                                                                 |         |                                                                        |          |
| 74HC175PW   | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | TSSOP16 | plastic thin shrink small outline package; 16 leads; body width 4.4 mm | SOT403-1 |
| 74HCT175PW  |                                                                 |         |                                                                        |          |

4. Functional diagram



5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

| Symbol     | Pin          | Description                                  |
|------------|--------------|----------------------------------------------|
| MR         | 1            | asynchronous master reset input (active LOW) |
| Q0 to Q3   | 2, 7, 10, 15 | flip-flop output                             |
| Q0̄ to Q3̄ | 3, 6, 11, 14 | complementary flip-flop output               |
| D0 to D3   | 4, 5, 12, 13 | data input                                   |
| GND        | 8            | ground (0 V)                                 |
| CP         | 9            | clock input (LOW-to-HIGH edge-triggered)     |
| VCC        | 16           | positive supply voltage                      |

6. Functional description

Table 3. Function table<sup>[1]</sup>

| Operating modes | Inputs |    |    | Outputs |                 |
|-----------------|--------|----|----|---------|-----------------|
|                 | MR     | CP | Dn | Qn      | $\overline{Qn}$ |
| reset (clear)   | L      | X  | X  | L       | H               |
| load "1"        | H      | ↑  | h  | H       | L               |
| load "0"        | H      | ↑  | l  | L       | H               |

- [1] H = HIGH voltage level;  
h = HIGH voltage level one set-up time prior to the LOW-to-HIGH clock transition;  
L = LOW voltage level;  
l = LOW voltage level one set-up time prior to the LOW-to-HIGH clock transition;  
X = don't care;  
↑ = LOW-to-HIGH clock transition.

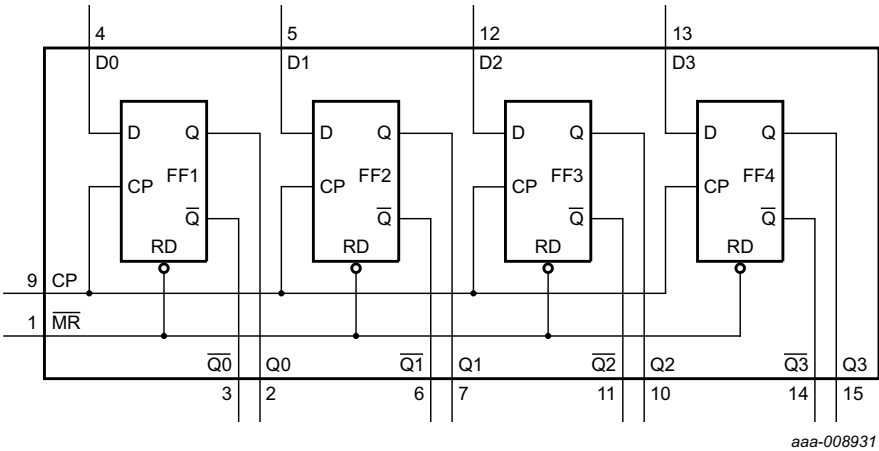


Fig 6. Functional diagram

## 7. Limiting values

**Table 4. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V)

| Symbol    | Parameter               | Conditions                                               | Min  | Max      | Unit |
|-----------|-------------------------|----------------------------------------------------------|------|----------|------|
| $V_{CC}$  | supply voltage          |                                                          | -0.5 | +7       | V    |
| $I_{IK}$  | input clamping current  | $V_I < -0.5 \text{ V}$ or $V_I > V_{CC} + 0.5 \text{ V}$ | -    | $\pm 20$ | mA   |
| $I_{OK}$  | output clamping current | $V_O < -0.5 \text{ V}$ or $V_O > V_{CC} + 0.5 \text{ V}$ | -    | $\pm 20$ | mA   |
| $I_O$     | output current          | $-0.5 \text{ V} < V_O < V_{CC} + 0.5 \text{ V}$          | -    | $\pm 25$ | mA   |
| $I_{CC}$  | supply current          |                                                          | -    | 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 $+125 \text{ °C}$          |      |          |      |
|           |                         | SO16, SSOP16 and TSSOP16 <a href="#">[1]</a>             | -    | 500      | mW   |

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

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

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Voltages are referenced to GND (ground = 0 V)

| Symbol              | Parameter                           | Conditions               | 74HC175 |      |          | 74HCT175 |      |          | 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     | -    | +125     | -40      | -    | +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 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  |      |
| 74HC175         |                           |                                                                                        |       |      |      |                  |      |                   |      |      |
| 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   | -                 | ±1   | 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   |
| 74HCT175        |                           |                                                                                        |       |      |      |                  |      |                   |      |      |
| 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> = –4.0 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; V <sub>CC</sub> = 4.5 V                                        | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 5.5 V                                       | -     | 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   | -                 | ±1   | μA   |

**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 |         |
| $I_{CC}$        | supply current            | $V_I = V_{CC}$ or GND; $I_O = 0$ A;<br>$V_{CC} = 5.5$ V                                                    | -     | -   | 8.0 | -                | 80  | -                 | 160 | $\mu$ A |
| $\Delta I_{CC}$ | additional supply current | per input pin;<br>$V_I = V_{CC} - 2.1$ V;<br>other inputs at $V_{CC}$ or GND;<br>$V_{CC} = 4.5$ V to 5.5 V |       |     |     |                  |     |                   |     |         |
|                 |                           | Dn input                                                                                                   | -     | 40  | 144 | -                | 180 | -                 | 196 | $\mu$ A |
|                 |                           | CP input                                                                                                   | -     | 60  | 216 | -                | 270 | -                 | 294 | $\mu$ A |
|                 |                           | MR input                                                                                                   | -     | 100 | 360 | -                | 450 | -                 | 490 | $\mu$ A |
| $C_I$           | input capacitance         |                                                                                                            | -     | 3.5 | -   | -                | -   | -                 | -   | pF      |

## 10. Dynamic characteristics

**Table 7.** Dynamic characteristicsGND (ground = 0 V);  $C_L = 50$  pF unless otherwise specified; for test circuit, see [Figure 10](#)

| Symbol           | Parameter                     | Conditions                                                                   | 25 °C |     |     | –40 °C to +85 °C |     | –40 °C to +125 °C |     | Unit |
|------------------|-------------------------------|------------------------------------------------------------------------------|-------|-----|-----|------------------|-----|-------------------|-----|------|
|                  |                               |                                                                              | Min   | Typ | Max | Min              | Max | Min               | Max |      |
| 74HC175          |                               |                                                                              |       |     |     |                  |     |                   |     |      |
| t <sub>pd</sub>  | propagation delay             | CP to Qn, $\overline{Qn}$ ; see <a href="#">Figure 7</a> <a href="#">[1]</a> |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 2.0 V                                                      | -     | 55  | 175 | -                | 220 | -                 | 265 | ns   |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                      | -     | 20  | 35  | -                | 44  | -                 | 53  | ns   |
|                  |                               | V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF                                | -     | 17  | -   | -                | -   | -                 | -   | ns   |
|                  |                               | V <sub>CC</sub> = 6.0 V                                                      | -     | 16  | 30  | -                | 37  | -                 | 45  | ns   |
| t <sub>PHL</sub> | HIGH to LOW propagation delay | $\overline{MR}$ to Qn, $\overline{Qn}$ ; see <a href="#">Figure 9</a>        |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 2.0 V                                                      | -     | 50  | 150 | -                | 190 | -                 | 225 | ns   |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                      | -     | 18  | 30  | -                | 38  | -                 | 45  | ns   |
|                  |                               | V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF                                | -     | 15  | -   | -                | -   | -                 | -   | ns   |
|                  |                               | V <sub>CC</sub> = 6.0 V                                                      | -     | 14  | 26  | -                | 33  | -                 | 38  | ns   |
| t <sub>t</sub>   | transition time               | Qn output; see <a href="#">Figure 7</a> <a href="#">[2]</a>                  |       |     |     |                  |     |                   |     |      |
|                  |                               | 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   |

**Table 7.** Dynamic characteristics ...continuedGND (ground = 0 V);  $C_L = 50$  pF unless otherwise specified; for test circuit, see [Figure 10](#)

| Symbol    | Parameter                     | Conditions                                                        | 25 °C |     |     | –40 °C to +85 °C |     | –40 °C to +125 °C |     | Unit |
|-----------|-------------------------------|-------------------------------------------------------------------|-------|-----|-----|------------------|-----|-------------------|-----|------|
|           |                               |                                                                   | Min   | Typ | Max | Min              | Max | Min               | Max |      |
| $t_W$     | pulse width                   | CP input HIGH or LOW;<br>see <a href="#">Figure 7</a>             |       |     |     |                  |     |                   |     |      |
|           |                               | $V_{CC} = 2.0$ V                                                  | 80    | 22  | -   | 100              | -   | 120               | -   | ns   |
|           |                               | $V_{CC} = 4.5$ V                                                  | 16    | 8   | -   | 20               | -   | 24                | -   | ns   |
|           |                               | $V_{CC} = 6.0$ V                                                  | 14    | 6   | -   | 17               | -   | 20                | -   | ns   |
|           |                               | $\overline{MR}$ input LOW;<br>see <a href="#">Figure 9</a>        |       |     |     |                  |     |                   |     |      |
|           |                               | $V_{CC} = 2.0$ V                                                  | 80    | 19  | -   | 100              | -   | 120               | -   | ns   |
|           |                               | $V_{CC} = 4.5$ V                                                  | 16    | 7   | -   | 20               | -   | 24                | -   | ns   |
|           |                               | $V_{CC} = 6.0$ V                                                  | 14    | 6   | -   | 17               | -   | 20                | -   | ns   |
| $t_{rec}$ | recovery time                 | $\overline{MR}$ to CP; see <a href="#">Figure 9</a>               |       |     |     |                  |     |                   |     |      |
|           |                               | $V_{CC} = 2.0$ V                                                  | 5     | –33 | -   | 5                | -   | 5                 | -   | ns   |
|           |                               | $V_{CC} = 4.5$ V                                                  | 5     | –12 | -   | 5                | -   | 5                 | -   | ns   |
|           |                               | $V_{CC} = 6.0$ V                                                  | 5     | –10 | -   | 5                | -   | 5                 | -   | ns   |
| $t_{su}$  | set-up time                   | Dn to CP; see <a href="#">Figure 7</a>                            |       |     |     |                  |     |                   |     |      |
|           |                               | $V_{CC} = 2.0$ V                                                  | 80    | 3   | -   | 100              | -   | 120               | -   | ns   |
|           |                               | $V_{CC} = 4.5$ V                                                  | 16    | 1   | -   | 20               | -   | 24                | -   | ns   |
|           |                               | $V_{CC} = 6.0$ V                                                  | 14    | 1   | -   | 17               | -   | 20                | -   | ns   |
| $t_h$     | hold time                     | Dn to CP; see <a href="#">Figure 7</a>                            |       |     |     |                  |     |                   |     |      |
|           |                               | $V_{CC} = 2.0$ V                                                  | 25    | 2   | -   | 30               | -   | 40                | -   | ns   |
|           |                               | $V_{CC} = 4.5$ V                                                  | 5     | 0   | -   | 6                | -   | 8                 | -   | ns   |
|           |                               | $V_{CC} = 6.0$ V                                                  | 4     | 0   | -   | 5                | -   | 7                 | -   | ns   |
|           |                               |                                                                   |       |     |     |                  |     |                   |     |      |
| $f_{max}$ | maximum frequency             | CP input; see <a href="#">Figure 7</a>                            |       |     |     |                  |     |                   |     |      |
|           |                               | $V_{CC} = 2.0$ V                                                  | 6     | 25  | -   | 4.8              | -   | 4                 | -   | MHz  |
|           |                               | $V_{CC} = 4.5$ V                                                  | 30    | 75  | -   | 24               | -   | 20                | -   | MHz  |
|           |                               | $V_{CC} = 5$ V; $C_L = 15$ pF                                     | -     | 83  | -   | -                | -   | -                 | -   | MHz  |
|           |                               | $V_{CC} = 6.0$ V                                                  | 35    | 89  | -   | 28               | -   | 24                | -   | MHz  |
| $C_{PD}$  | power dissipation capacitance | per package;<br>$V_I = \text{GND to } V_{CC}$ <a href="#">[3]</a> | -     | 32  | -   | -                | -   | -                 | -   | pF   |

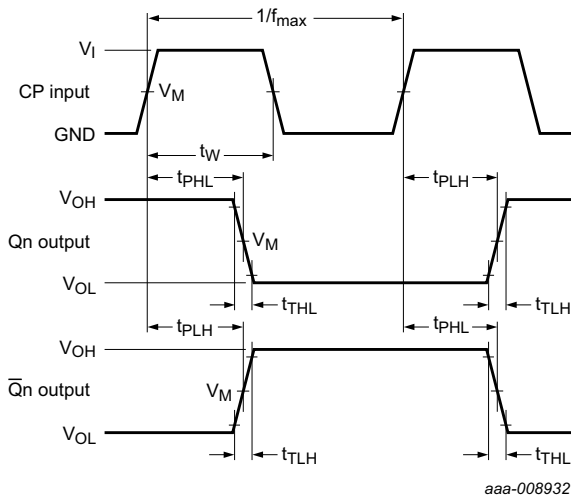


**Table 7. Dynamic characteristics ...continued**GND (ground = 0 V);  $C_L = 50$  pF unless otherwise specified; for test circuit, see [Figure 10](#)

| Symbol           | Parameter                     | Conditions                                                                            | 25 °C |     |     | –40 °C to +85 °C |     | –40 °C to +125 °C |     | Unit |
|------------------|-------------------------------|---------------------------------------------------------------------------------------|-------|-----|-----|------------------|-----|-------------------|-----|------|
|                  |                               |                                                                                       | Min   | Typ | Max | Min              | Max | Min               | Max |      |
| 74HCT175         |                               |                                                                                       |       |     |     |                  |     |                   |     |      |
| t <sub>pd</sub>  | propagation delay             | CP to Q <sub>n</sub> , $\overline{Q}_n$ ; see <a href="#">Figure 7</a> <sup>[1]</sup> |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                               | -     | 19  | 33  | -                | 41  | -                 | 50  | ns   |
|                  |                               | V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF                                         | -     | 16  | -   | -                | -   | -                 | -   | ns   |
| t <sub>PHL</sub> | HIGH to LOW propagation delay | MR to Q <sub>n</sub> ; see <a href="#">Figure 9</a>                                   |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                               | -     | 22  | 38  | -                | 48  | -                 | 57  | ns   |
|                  |                               | V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF                                         | -     | 19  | -   | -                | -   | -                 | -   | ns   |
|                  |                               | $\overline{MR}$ to $\overline{Q}_n$ ; see <a href="#">Figure 9</a>                    |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                               | -     | 19  | 35  | -                | 44  | -                 | 53  | ns   |
|                  |                               | V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF                                         | -     | 16  | -   | -                | -   | -                 | -   | ns   |
| t <sub>t</sub>   | transition time               | Q <sub>n</sub> output; see <a href="#">Figure 7</a> <sup>[2]</sup>                    |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                               | -     | 7   | 15  | -                | 19  | -                 | 22  | ns   |
| t <sub>W</sub>   | pulse width                   | CP input; see <a href="#">Figure 7</a>                                                |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                               | 20    | 12  | -   | 25               | -   | 30                | -   | ns   |
|                  |                               | $\overline{MR}$ input LOW; see <a href="#">Figure 9</a>                               |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                               | 20    | 11  | -   | 25               | -   | 30                | -   | ns   |
| t <sub>rec</sub> | recovery time                 | $\overline{MR}$ to CP; see <a href="#">Figure 9</a>                                   |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                               | 5     | –10 | -   | 5                | -   | 5                 | -   | ns   |
| t <sub>su</sub>  | set-up time                   | D <sub>n</sub> to CP; see <a href="#">Figure 7</a>                                    |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                               | 16    | 5   | -   | 20               | -   | 24                | -   | ns   |
| t <sub>h</sub>   | hold time                     | D <sub>n</sub> to CP; see <a href="#">Figure 7</a>                                    |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                               | 5     | 0   | -   | 5                | -   | 5                 | -   | ns   |
| f <sub>max</sub> | maximum frequency             | CP input; see <a href="#">Figure 7</a>                                                |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                               | 25    | 49  | -   | 20               | -   | 17                | -   | MHz  |
|                  |                               | V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF                                         | -     | 54  | -   | -                | -   | -                 | -   | MHz  |
| C <sub>PD</sub>  | power dissipation capacitance | per package; V <sub>I</sub> = GND to V <sub>CC</sub> – 1.5 V <sup>[3]</sup>           | -     | 34  | -   | -                | -   | -                 | -   | pF   |

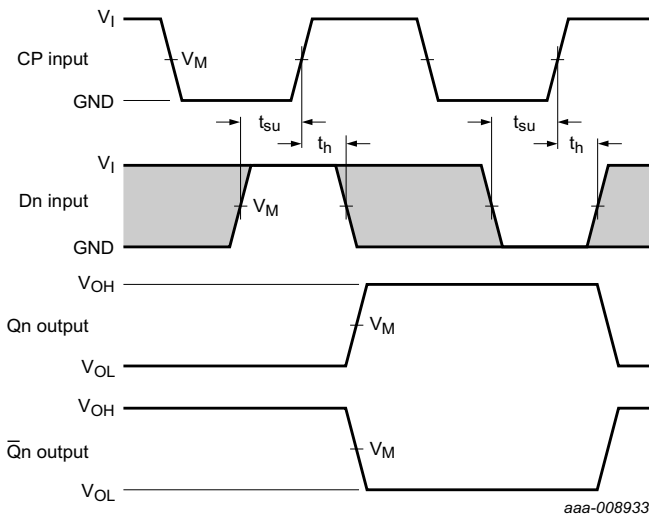
[1]  $t_{pd}$  is the same as  $t_{PHL}$  and  $t_{PLH}$ .[2]  $t_t$  is the same as  $t_{THL}$  and  $t_{TLH}$ .[3]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu W$ ). $P_D = C_{PD} \times V_{CC}^2 \times f_i + \Sigma (C_L \times V_{CC}^2 \times f_o)$  where: $f_i$  = input frequency in MHz; $f_o$  = output frequency in MHz; $\Sigma (C_L \times V_{CC}^2 \times f_o)$  = sum of outputs; $C_L$  = output load capacitance in pF; $V_{CC}$  = supply voltage in V.

11. Waveforms



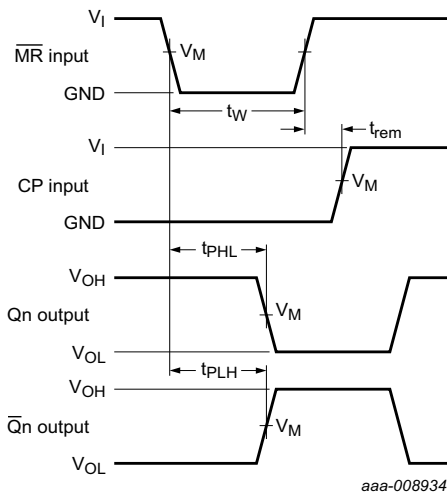
Measurement points are given in [Table 8](#).

Fig 7. Input to output propagation delay, output transition time, clock input pulse width and maximum frequency



Measurement points are given in [Table 8](#).

Fig 8. Data set-up and hold times for data input

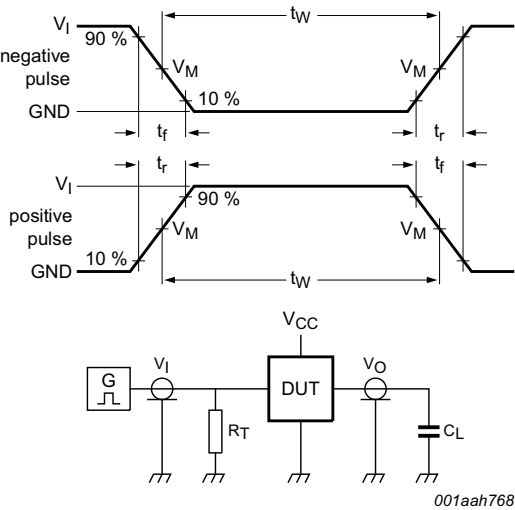


Measurement points are given in [Table 8](#).

**Fig 9.** Master reset to output propagation delays, master reset pulse width and master reset to clock recovery time

**Table 8.** Measurement points

| Type     | Input    |             | Output      |
|----------|----------|-------------|-------------|
|          | $V_I$    | $V_M$       | $V_M$       |
| 74HC175  | $V_{CC}$ | $0.5V_{CC}$ | $0.5V_{CC}$ |
| 74HCT175 | 3 V      | 1.3 V       | 1.3 V       |



Test data is given in [Table 9](#).

Definitions for 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.

Fig 10. Test circuit for measuring switching times

Table 9. Test data

| Type     | Input    |            | Load         |              | Test               |
|----------|----------|------------|--------------|--------------|--------------------|
|          | $V_I$    | $t_r, t_f$ | $C_L$        | $R_L$        |                    |
| 74HC175  | $V_{CC}$ | 6 ns       | 15 pF, 50 pF | 1 k $\Omega$ | $t_{PLH}, t_{PHL}$ |
| 74HCT175 | 3 V      | 6 ns       | 15 pF, 50 pF | 1 k $\Omega$ | $t_{PLH}, t_{PHL}$ |

12. Package outline

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

SOT109-1

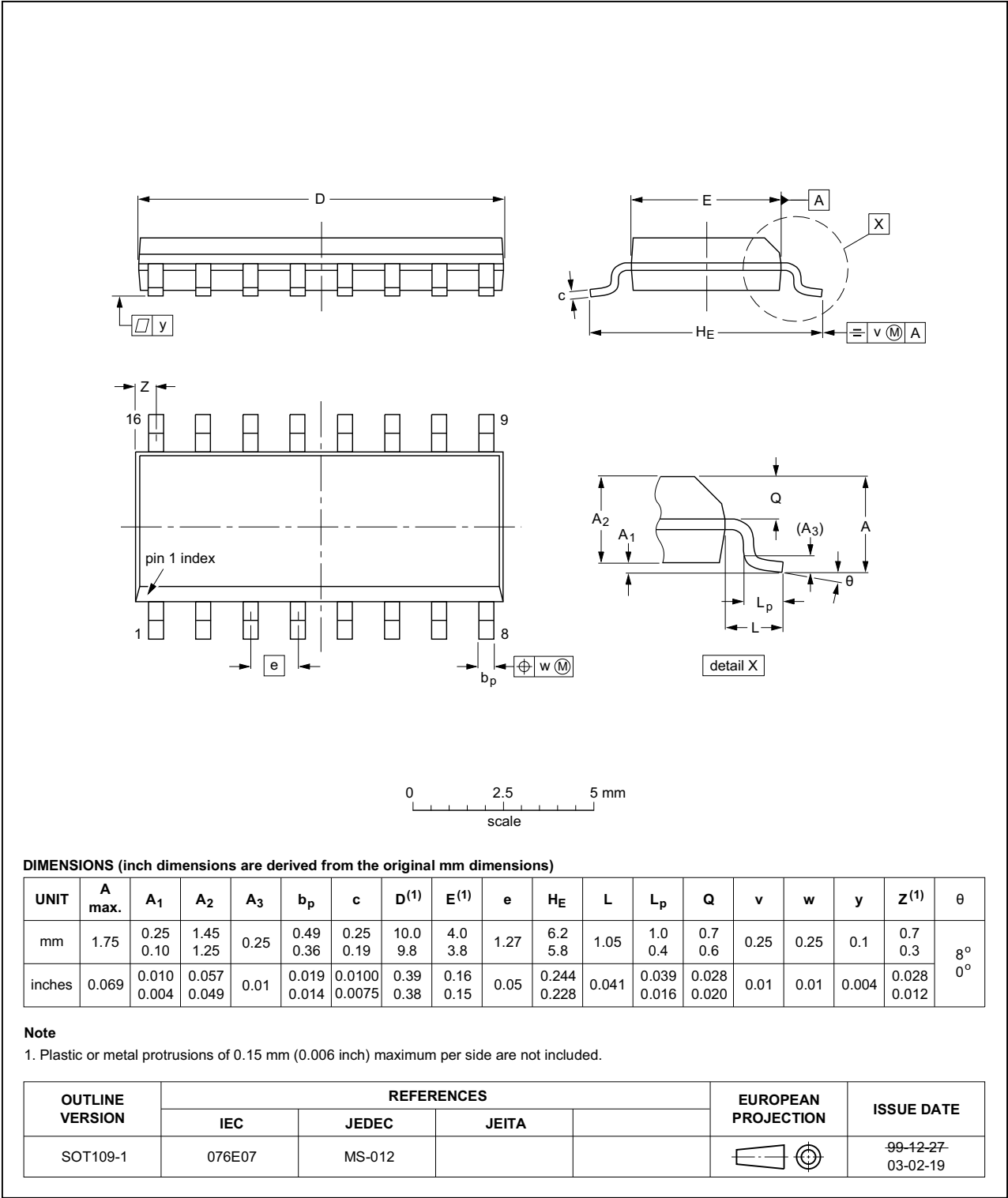


Fig 11. Package outline SOT109-1 (SO16)

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

SOT338-1

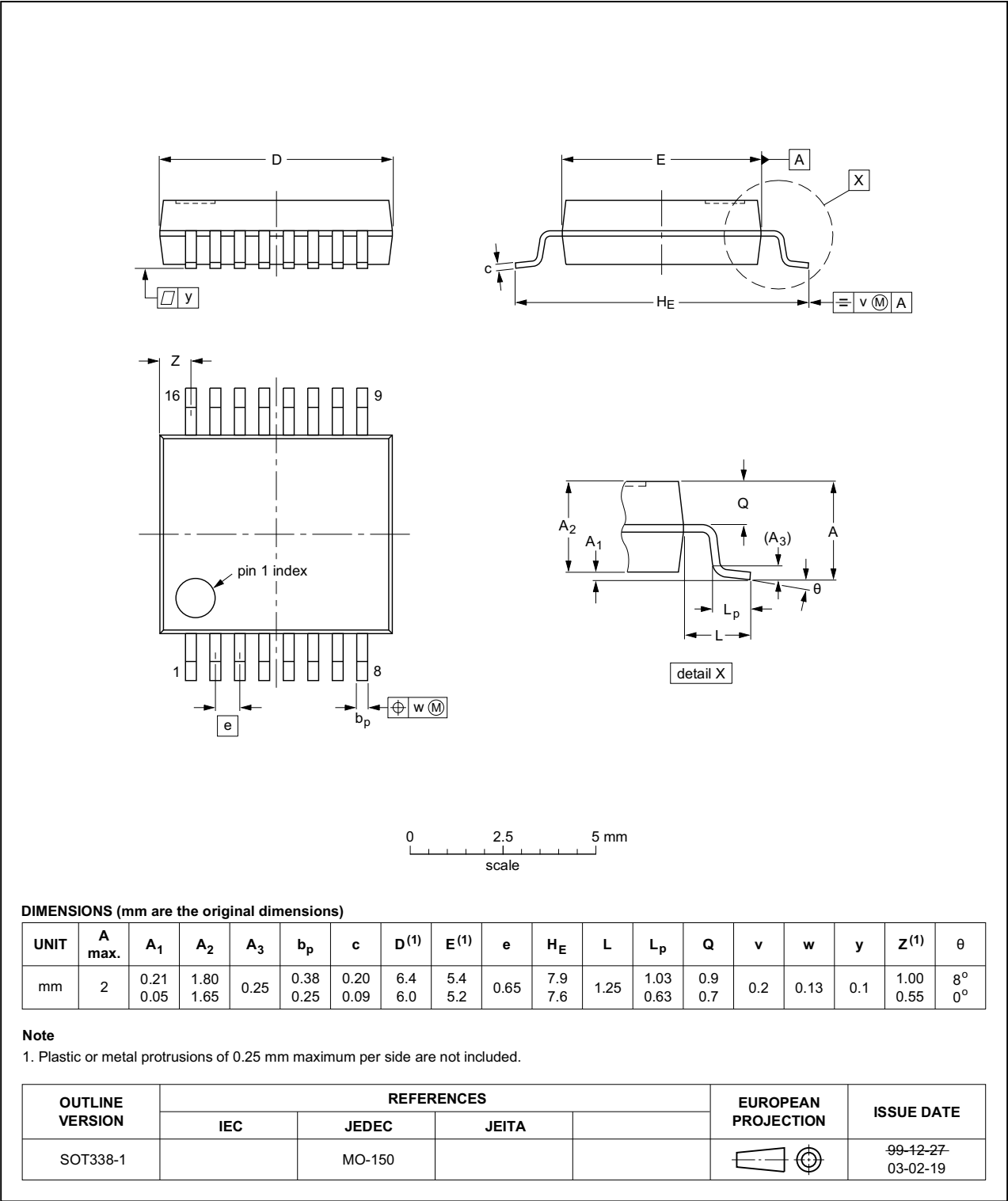


Fig 12. Package outline SOT338-1 (SSOP16)

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

SOT403-1

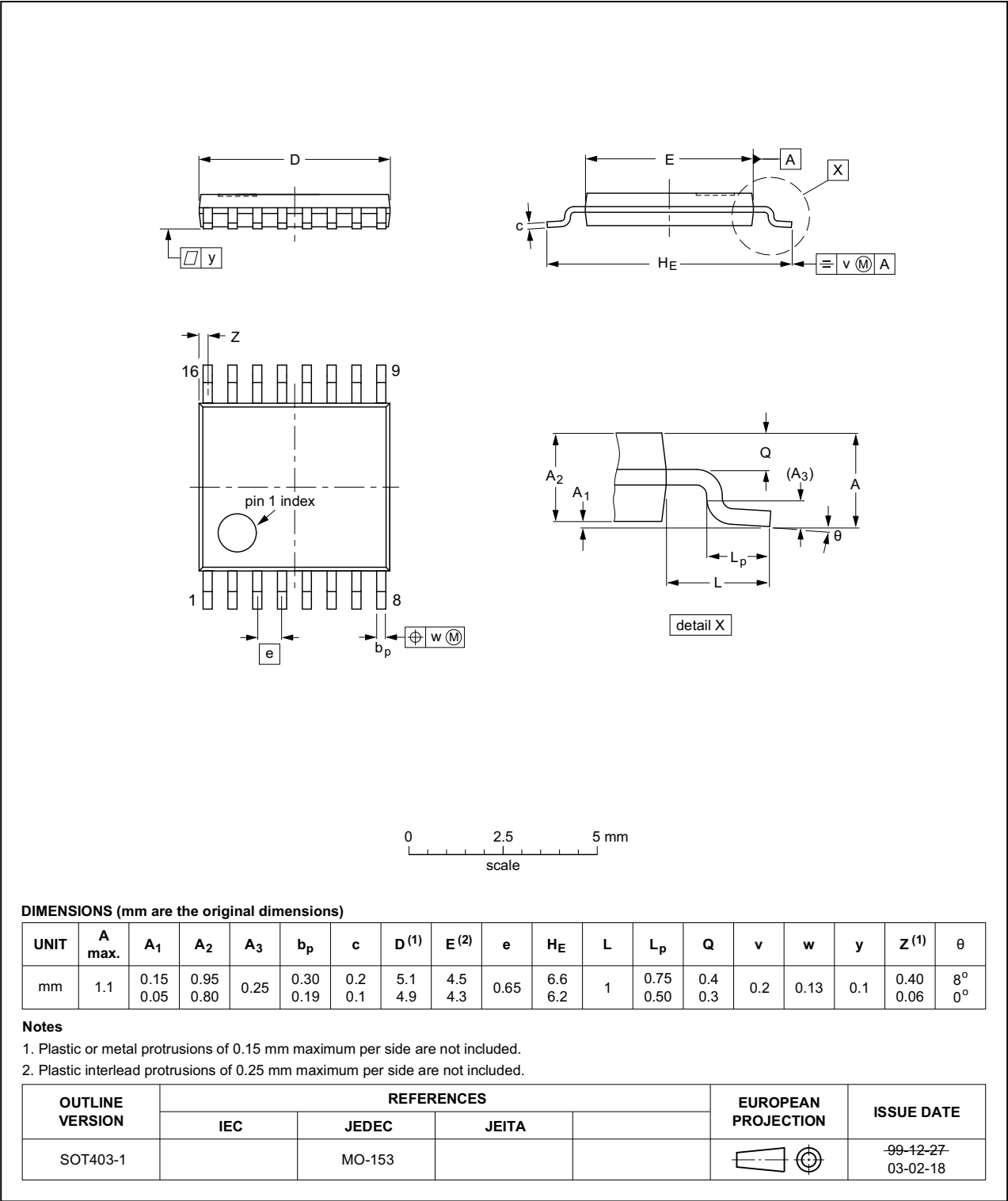


Fig 13. Package outline SOT403-1 (TSSOP16)

## 13. Abbreviations

Table 10. Abbreviations

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

## 14. Revision history

Table 11. Revision history

| Document ID       | Release date                                                                                                                                                                                        | Data sheet status     | Change notice | Supersedes        |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|-------------------|
| 74HC_HCT175 v.5   | 20160129                                                                                                                                                                                            | Product data sheet    | -             | 74HC_HCT175 v.4   |
| Modifications:    | • Type numbers 74HC175N and 74HCT175N (SOT38-4) removed.                                                                                                                                            |                       |               |                   |
| 74HC_HCT175 v.4   | 20140408                                                                                                                                                                                            | Product data sheet    | -             | 74HC_HCT175 v.3   |
| Modifications:    | • General description corrected (errata).                                                                                                                                                           |                       |               |                   |
| 74HC_HCT175 v.3   | 20140331                                                                                                                                                                                            | Product data sheet    | -             | 74HC_HCT175_CNV_2 |
| Modifications:    | • The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.<br>• Legal texts have been adapted to the new company name where appropriate. |                       |               |                   |
| 74HC_HCT175_CNV_2 | 19980708                                                                                                                                                                                            | Product specification | -             | -                 |



## 15. Legal information

### 15.1 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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