

# 74HC390; 74HCT390

## Dual decade ripple counter

Rev. 6 — 19 March 2024

Product data sheet

## 1. General description

The 74HC390; 74HCT390 is a dual 4-bit decade ripple counter divided into four separately clocked sections. The counters have two divide-by-2 sections and two divide-by-5 sections. These sections share an asynchronous master reset input (nMR) and can be used in a BCD decade or bi-quinary configuration. If master reset inputs (1MR and 2MR) are used to simultaneously clear all 8 bits of the counter, a number of counting configurations are possible within one package. The separate clocks (nCP0 and nCP1) of each section allow ripple counter or frequency division applications of divide-by-2, 4, 5, 10, 20, 25, 50 or 100. Each section is triggered by the HIGH-to-LOW transition of the clock inputs (nCP0 and nCP1). For BCD decade operation, the nQ0 output is connected to the nCP1 input of the divide-by-5 section. For bi-quinary decade operation, the nQ3 output is connected to the nCP0 input and nQ0 becomes the decade output. A HIGH on the nMR input overrides the clocks and sets the four outputs LOW. This device features reduced input threshold levels to allow interfacing to TTL logic levels. Inputs also 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 74HC390: CMOS level
  - For 74HCT390: TTL level
- Two BCD decade or bi-quinary counters
- One device can be configured to divide-by-2, 4, 5, 10, 20, 25, 50 or 100
- Two master reset inputs to clear each decade counter individually
- Supply voltage range from 4.5 V to 5.5 V
- High noise immunity
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Complies with JEDEC standard JEDEC7A (4.5 V to 5.5 V)
- ESD protection:
  - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
  - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

## 3. Ordering information

Table 1. Ordering information

| Type number                | Package           |         |                                                                           |                          |
|----------------------------|-------------------|---------|---------------------------------------------------------------------------|--------------------------|
|                            | Temperature range | Name    | Description                                                               | Version                  |
| <a href="#">74HC390D</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="#">74HCT390D</a>  |                   |         |                                                                           |                          |
| <a href="#">74HC390PW</a>  | -40 °C to +125 °C | TSSOP16 | plastic thin shrink small outline package; 16 leads;<br>body width 4.4 mm | <a href="#">SOT403-1</a> |
| <a href="#">74HCT390PW</a> |                   |         |                                                                           |                          |

4. Functional diagram

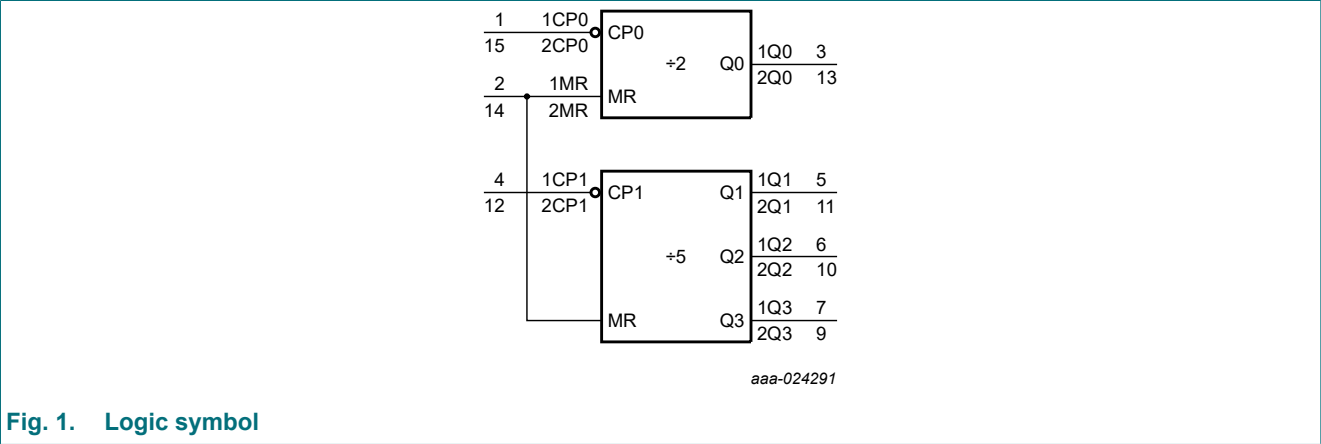


Fig. 1. Logic symbol

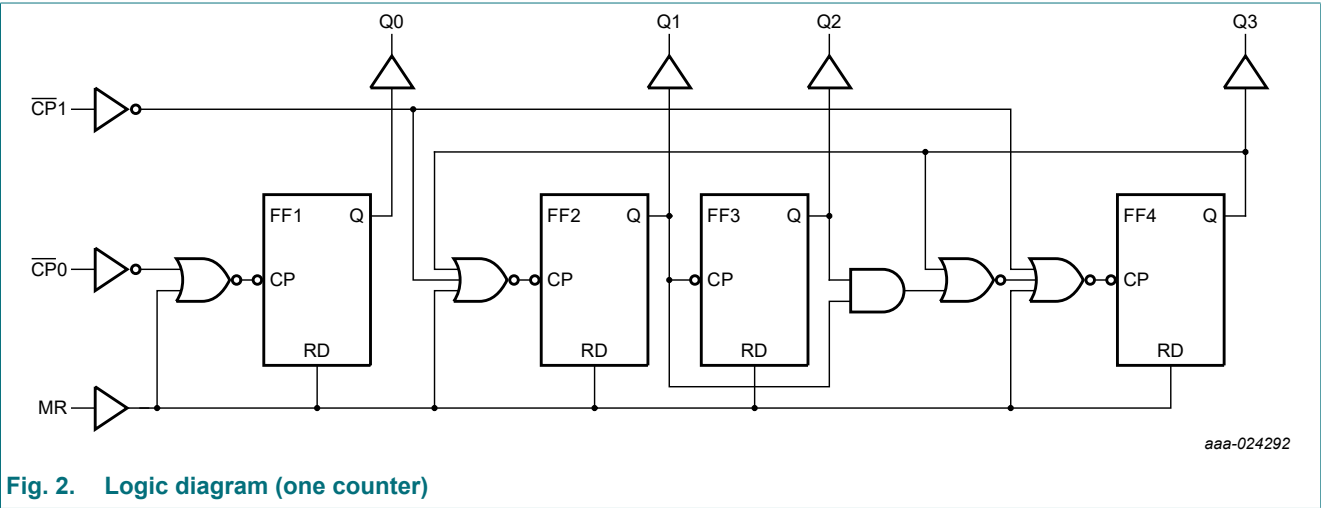


Fig. 2. Logic diagram (one counter)

5. Pinning information

5.1. Pinning

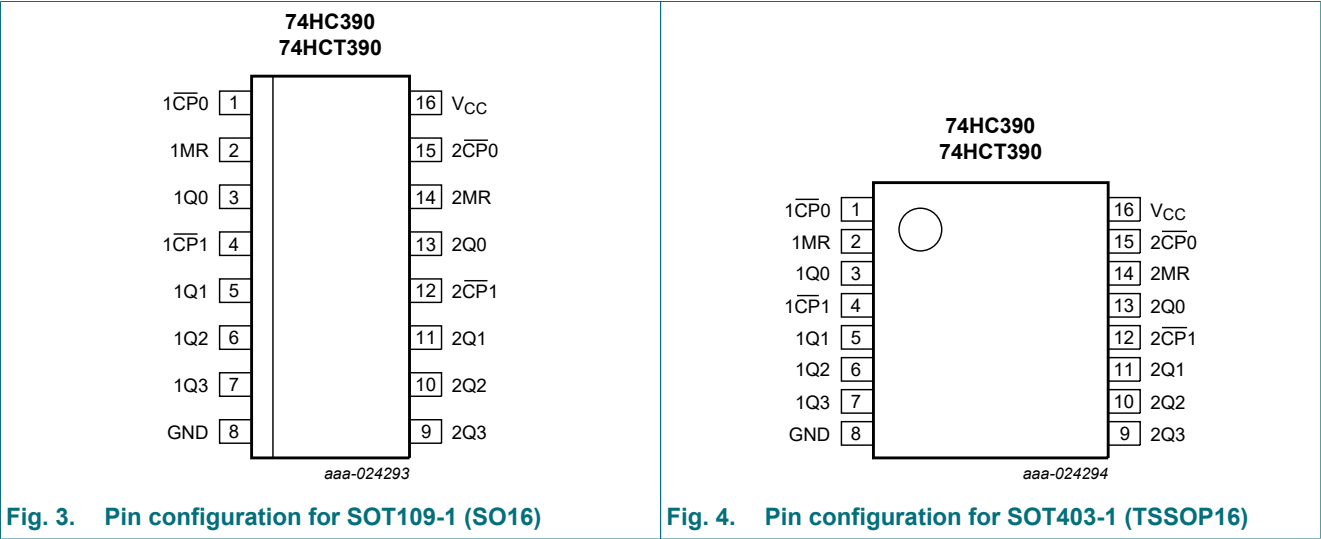


Fig. 3. Pin configuration for SOT109-1 (SO16)

Fig. 4. Pin configuration for SOT403-1 (TSSOP16)

5.2. Pin description

Table 2. Pin description

| Symbol             | Pin           | Description                                                   |
|--------------------|---------------|---------------------------------------------------------------|
| 1CP0, 2CP0         | 1, 15         | clock input divide-by-2 section (HIGH-to-LOW; edge-triggered) |
| 1MR, 2MR           | 2, 14         | asynchronous master reset input (active HIGH)                 |
| 1Q0, 1Q1, 1Q2, 1Q3 | 3, 5, 6, 7    | flip-flop outputs                                             |
| 1CP1, 2CP1         | 4, 12         | clock input divide-by-5 section (HIGH-to-LOW; edge-triggered) |
| GND                | 8             | ground (0 V)                                                  |
| 2Q0, 2Q1, 2Q2, 2Q3 | 13, 11, 10, 9 | flip-flop outputs                                             |
| VCC                | 16            | supply voltage                                                |

6. Functional description

Table 3. BCD count sequence

Output nQ0 connected to nCP1; counter input on nCP0;  
H = HIGH voltage level; L = LOW voltage level

| Count | Output |     |     |     |
|-------|--------|-----|-----|-----|
|       | nQ0    | nQ1 | nQ2 | nQ3 |
| 0     | L      | L   | L   | L   |
| 1     | H      | L   | L   | L   |
| 2     | L      | H   | L   | L   |
| 3     | H      | H   | L   | L   |
| 4     | L      | L   | H   | L   |
| 5     | H      | L   | H   | L   |
| 6     | L      | H   | H   | L   |
| 7     | H      | H   | H   | L   |
| 8     | L      | L   | L   | H   |
| 9     | H      | L   | L   | H   |

Table 4. Bi-quinary count sequence

Output nQ3 connected to nCP0; counter input on nCP1;  
H = HIGH voltage level; L = LOW voltage level

| Count | Output |     |     |     |
|-------|--------|-----|-----|-----|
|       | nQ0    | nQ1 | nQ2 | nQ3 |
| 0     | L      | L   | L   | L   |
| 1     | L      | H   | L   | L   |
| 2     | L      | L   | H   | L   |
| 3     | L      | H   | H   | L   |
| 4     | L      | L   | L   | H   |
| 5     | H      | L   | L   | L   |
| 6     | H      | H   | L   | L   |
| 7     | H      | L   | H   | L   |
| 8     | H      | H   | H   | L   |
| 9     | H      | L   | L   | H   |

7. Limiting values

Table 5. Limiting values

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

| Symbol           | Parameter               | Conditions                                                          | Min  | Max  | Unit |
|------------------|-------------------------|---------------------------------------------------------------------|------|------|------|
| V <sub>CC</sub>  | supply voltage          |                                                                     | -0.5 | +7   | V    |
| I <sub>IK</sub>  | input clamping current  | V <sub>I</sub> < -0.5 V or V <sub>I</sub> > V <sub>CC</sub> + 0.5 V | -    | ±20  | mA   |
| I <sub>OK</sub>  | output clamping current | V <sub>O</sub> < -0.5 V or V <sub>O</sub> > V <sub>CC</sub> + 0.5 V | -    | ±20  | mA   |
| I <sub>O</sub>   | output current          | -0.5 V < V <sub>O</sub> < V <sub>CC</sub> + 0.5 V                   | -    | ±25  | mA   |
| I <sub>CC</sub>  | supply current          |                                                                     | -    | +50  | mA   |
| I <sub>GND</sub> | ground current          |                                                                     | -50  | -    | mA   |
| T <sub>stg</sub> | storage temperature     |                                                                     | -65  | +150 | °C   |
| P <sub>tot</sub> | total power dissipation | [1]                                                                 | -    | 500  | mW   |

- [1] For SOT109-1 (SO16) package: P<sub>tot</sub> derates linearly with 12.4 mW/K above 110 °C.  
For SOT403-1 (TSSOP16) package: P<sub>tot</sub> derates linearly with 8.5 mW/K above 91 °C.

8. Recommended operating conditions

Table 6. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V)

| Symbol           | Parameter                           | Conditions              | 74HC390 |      |                 | 74HCT390 |      |                 | 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 |

9. Static characteristics

Table 7. 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  |      |
| 74HC390         |                          |                         |       |     |      |                  |      |                   |      |      |
| 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    |

| Symbol           | Parameter                 | Conditions                                                                                                                        | 25 °C |      |      | -40 °C to +85 °C |       | -40 °C to +125 °C |       | Unit |
|------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------|------|------|------------------|-------|-------------------|-------|------|
|                  |                           |                                                                                                                                   | Min   | Typ  | Max  | Min              | Max   | Min               | Max   |      |
| 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   |
| 74HCT390         |                           |                                                                                                                                   |       |      |      |                  |       |                   |       |      |
| 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> = 4.0 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   |
| 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; other inputs at V <sub>CC</sub> or GND; V <sub>CC</sub> = 4.5 V to 5.5 V |       |      |      |                  |       |                   |       |      |
|                  |                           | nCP0 inputs                                                                                                                       | -     | 45   | 162  | -                | 202.5 | -                 | 220.5 | µA   |
|                  |                           | nCP1, nMR inputs                                                                                                                  | -     | 60   | 216  | -                | 270   | -                 | 294   | µA   |
| C <sub>I</sub>   | input capacitance         |                                                                                                                                   | -     | 3.5  | -    | -                | -     | -                 | -     | pF   |

10. Dynamic characteristics

Table 8. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V);  $C_L = 50\text{ pF}$  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 [1] | Max | Min              | Max | Min               | Max |      |
| 74HC390          |                               |                                               |       |         |     |                  |     |                   |     |      |
| t <sub>pd</sub>  | propagation delay             | nCP0 to nQ0; see Fig. 5 [2]                   |       |         |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 2.0 V                       | -     | 47      | 145 | -                | 180 | -                 | 220 | ns   |
|                  |                               | V <sub>CC</sub> = 4.5 V                       | -     | 17      | 29  | -                | 36  | -                 | 44  | ns   |
|                  |                               | V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF | -     | 14      | -   | -                | -   | -                 | -   | ns   |
|                  |                               | V <sub>CC</sub> = 6.0 V                       | -     | 14      | 25  | -                | 31  | -                 | 38  | ns   |
|                  |                               | nCP1 to nQ1; see Fig. 5                       |       |         |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 2.0 V                       | -     | 50      | 155 | -                | 195 | -                 | 235 | ns   |
|                  |                               | V <sub>CC</sub> = 4.5 V                       | -     | 18      | 31  | -                | 39  | -                 | 47  | 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  | -                 | 40  | ns   |
|                  |                               | nCP1 to nQ2; see Fig. 5                       |       |         |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 2.0 V                       | -     | 74      | 210 | -                | 265 | -                 | 315 | ns   |
|                  |                               | V <sub>CC</sub> = 4.5 V                       | -     | 27      | 42  | -                | 53  | -                 | 63  | ns   |
|                  |                               | V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF | -     | 23      | -   | -                | -   | -                 | -   | ns   |
|                  |                               | V <sub>CC</sub> = 6.0 V                       | -     | 22      | 36  | -                | 45  | -                 | 54  | ns   |
|                  |                               | nCP1 to nQ3; see Fig. 5                       |       |         |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 2.0 V                       | -     | 50      | 155 | -                | 195 | -                 | 235 | ns   |
|                  |                               | V <sub>CC</sub> = 4.5 V                       | -     | 18      | 31  | -                | 39  | -                 | 47  | 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  | -                 | 40  | ns   |
| t <sub>PHL</sub> | HIGH to LOW propagation delay | nMR to nQn; see Fig. 6                        |       |         |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 2.0 V                       | -     | 52      | 165 | -                | 205 | -                 | 250 | ns   |
|                  |                               | 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   |
|                  |                               | V <sub>CC</sub> = 6.0 V                       | -     | 15      | 28  | -                | 35  | -                 | 43  | ns   |
| t <sub>t</sub>   | transition time               | nQn; see Fig. 5 [3]                           |       |         |     |                  |     |                   |     |      |
|                  |                               | 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   |

| Symbol           | Parameter                     | Conditions                                                                     | 25 °C |         |     | -40 °C to +85 °C |     | -40 °C to +125 °C |     | Unit |
|------------------|-------------------------------|--------------------------------------------------------------------------------|-------|---------|-----|------------------|-----|-------------------|-----|------|
|                  |                               |                                                                                | Min   | Typ [1] | Max | Min              | Max | Min               | Max |      |
| t <sub>W</sub>   | pulse width                   | nCP0, nCP1; HIGH or LOW; see Fig. 5                                            |       |         |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 2.0 V                                                        | 80    | 19      | -   | 100              | -   | 120               | -   | ns   |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                        | 16    | 7       | -   | 20               | -   | 24                | -   | ns   |
|                  |                               | V <sub>CC</sub> = 6.0 V                                                        | 14    | 6       | -   | 17               | -   | 20                | -   | ns   |
|                  |                               | nMR HIGH; see Fig. 6                                                           |       |         |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 2.0 V                                                        | 80    | 28      | -   | 105              | -   | 130               | -   | ns   |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                        | 17    | 10      | -   | 21               | -   | 26                | -   | ns   |
|                  |                               | V <sub>CC</sub> = 6.0 V                                                        | 14    | 8       | -   | 18               | -   | 22                | -   | ns   |
| t <sub>rec</sub> | recovery time                 | nMR to nCPn; see Fig. 6                                                        |       |         |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 2.0 V                                                        | 75    | 22      | -   | 95               | -   | 110               | -   | ns   |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                        | 15    | 8       | -   | 19               | -   | 22                | -   | ns   |
|                  |                               | V <sub>CC</sub> = 6.0 V                                                        | 13    | 6       | -   | 16               | -   | 19                | -   | ns   |
| f <sub>max</sub> | maximum frequency             | nCPn; see Fig. 5                                                               |       |         |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 2.0 V                                                        | 6.0   | 20      | -   | 4.8              | -   | 4.0               | -   | MHz  |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                        | 30    | 60      | -   | 24               | -   | 20                | -   | MHz  |
|                  |                               | V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF                                  | -     | 66      | -   | -                | -   | -                 | -   | MHz  |
|                  |                               | V <sub>CC</sub> = 6.0 V                                                        | 35    | 71      | -   | 28               | -   | 24                | -   | MHz  |
| C <sub>PD</sub>  | power dissipation capacitance | C <sub>L</sub> = 50 pF; f = 1 MHz; V <sub>I</sub> = GND to V <sub>CC</sub> [4] | -     | 20      | -   | -                | -   | -                 | -   | pF   |
| 74HCT390         |                               |                                                                                |       |         |     |                  |     |                   |     |      |
| t <sub>pd</sub>  | propagation delay             | nCP0 to nQ0; see Fig. 5 [2]                                                    |       |         |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                        | -     | 21      | 34  | -                | 43  | -                 | 51  | ns   |
|                  |                               | V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF                                  | -     | 18      | -   | -                | -   | -                 | -   | ns   |
|                  |                               | nCP1 to nQ1; see Fig. 5                                                        |       |         |     |                  |     |                   |     |      |
|                  |                               | 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   |
|                  |                               | nCP1 to nQ2; see Fig. 5                                                        |       |         |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                        | -     | 30      | 51  | -                | 64  | -                 | 77  | ns   |
|                  |                               | V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF                                  | -     | 26      | -   | -                | -   | -                 | -   | ns   |
|                  |                               | nCP1 to nQ3; see Fig. 5                                                        |       |         |     |                  |     |                   |     |      |
|                  |                               | 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   |
| t <sub>PHL</sub> | HIGH to LOW propagation delay | nMR to nQn; see Fig. 6                                                         |       |         |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                        | -     | 21      | 36  | -                | 45  | -                 | 54  | ns   |
|                  |                               | V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF                                  | -     | 18      | -   | -                | -   | -                 | -   | ns   |
| t <sub>t</sub>   | transition time               | nQn; see Fig. 5 [3]                                                            |       |         |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                        | -     | 7       | 15  | -                | 19  | -                 | 22  | ns   |

| Symbol           | Parameter                     | Conditions                                                                             | 25 °C |         |     | -40 °C to +85 °C |     | -40 °C to +125 °C |     | Unit |
|------------------|-------------------------------|----------------------------------------------------------------------------------------|-------|---------|-----|------------------|-----|-------------------|-----|------|
|                  |                               |                                                                                        | Min   | Typ [1] | Max | Min              | Max | Min               | Max |      |
| t <sub>W</sub>   | pulse width                   | nCP0, nCP1; HIGH or LOW; see Fig. 5                                                    |       |         |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                                | 18    | 8       | -   | 23               | -   | 27                | -   | ns   |
|                  |                               | nMR HIGH; see Fig. 6                                                                   |       |         |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                                | 17    | 10      | -   | 21               | -   | 26                | -   | ns   |
| t <sub>rec</sub> | recovery time                 | nMR to nCPn; see Fig. 6                                                                |       |         |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                                | 15    | 8       | -   | 19               | -   | 22                | -   | ns   |
| f <sub>max</sub> | maximum frequency             | nCPn; see Fig. 5                                                                       |       |         |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                                | 27    | 55      | -   | 22               | -   | 18                | -   | MHz  |
|                  |                               | V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF                                          | -     | 61      | -   | -                | -   | -                 | -   | MHz  |
| C <sub>PD</sub>  | power dissipation capacitance | C <sub>L</sub> = 50 pF; f = 1 MHz; V <sub>I</sub> = GND to V <sub>CC</sub> - 1.5 V [4] | -     | 21      | -   | -                | -   | -                 | -   | pF   |

[1] All typical values are measured at T<sub>amb</sub> = 25 °C.  
[2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.  
[3] t<sub>i</sub> is the same as t<sub>THL</sub> and t<sub>TLH</sub>.  
[4] 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.

10.1. Waveforms and test circuit

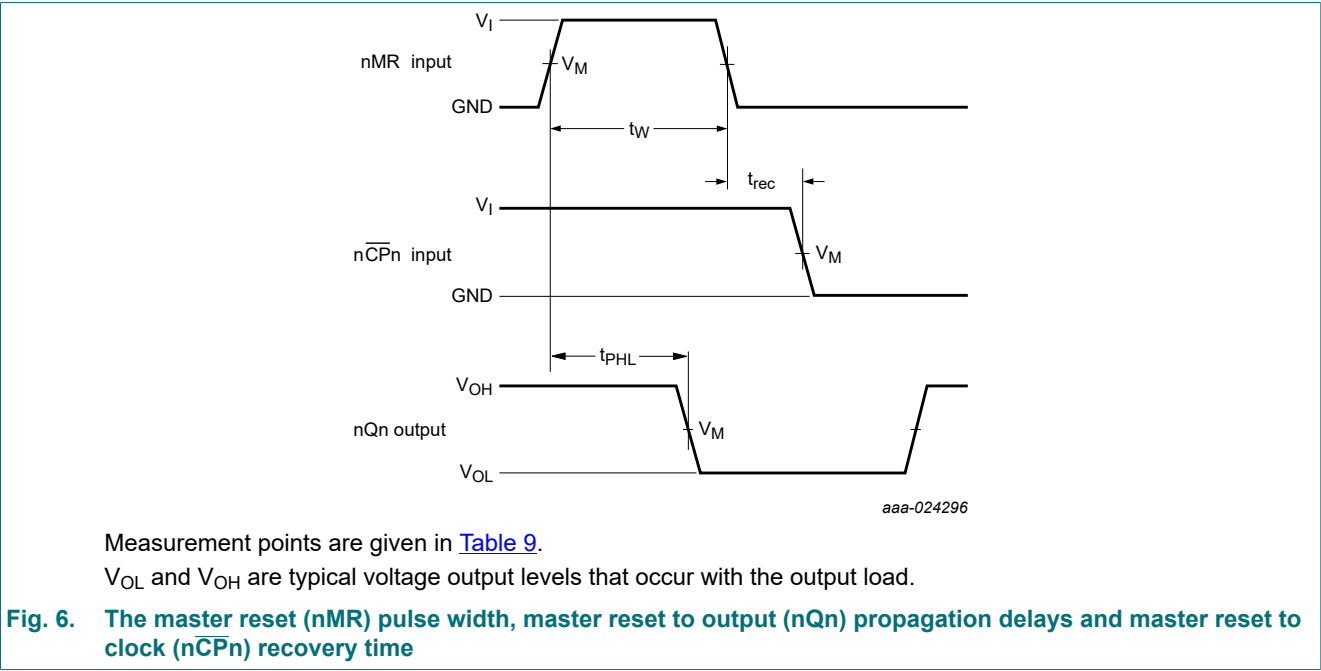
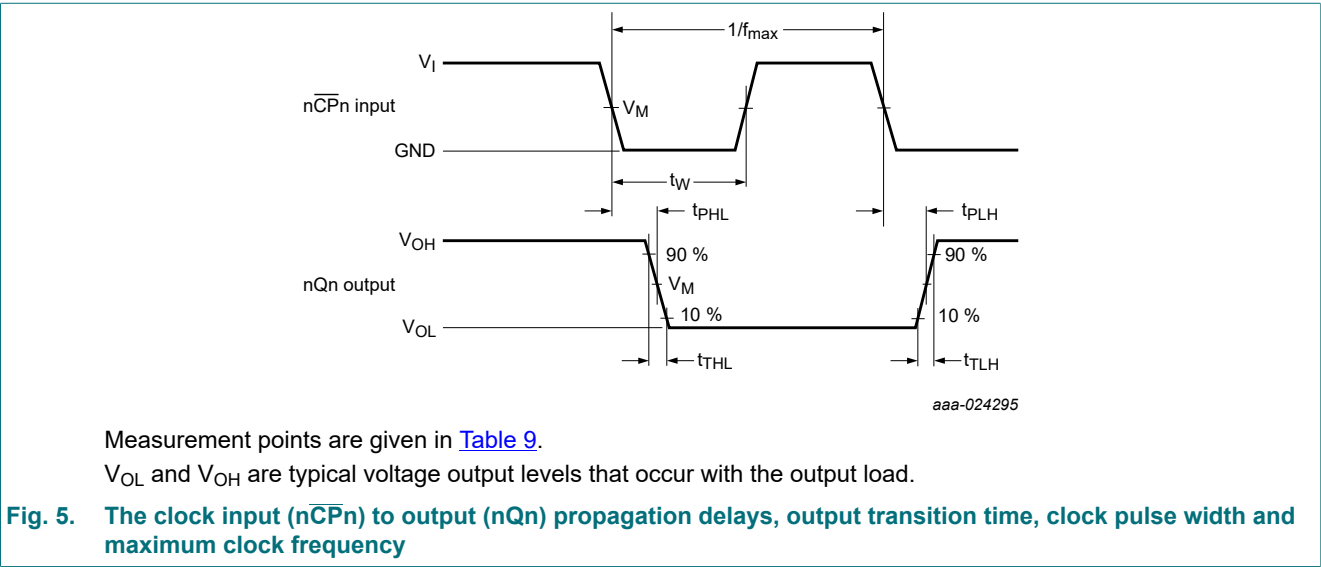
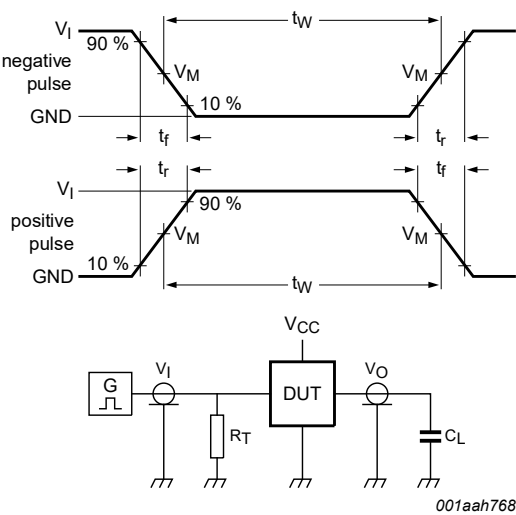


Table 9. Measurement points

| Type     | Input       | Output      |
|----------|-------------|-------------|
|          | $V_M$       | $V_M$       |
| 74HC390  | $0.5V_{CC}$ | $0.5V_{CC}$ |
| 74HCT390 | 1.3 V       | 1.3 V       |



Test data is given in [Table 10](#).  
Definitions test circuit:  
 $R_T$  = Termination resistance should be equal to output impedance  $Z_o$  of the pulse generator.  
 $C_L$  = Load capacitance including jig and probe capacitance.

Fig. 7. Test circuit for measuring switching times

Table 10. Test data

| Type     | Input    |            | Load         | Test               |
|----------|----------|------------|--------------|--------------------|
|          | $V_I$    | $t_r, t_f$ | $C_L$        |                    |
| 74HC390  | $V_{CC}$ | 6 ns       | 15 pF, 50 pF | $t_{PLH}, t_{PHL}$ |
| 74HCT390 | 3 V      | 6 ns       | 15 pF, 50 pF | $t_{PLH}, t_{PHL}$ |

11. Package outline

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

SOT109-1

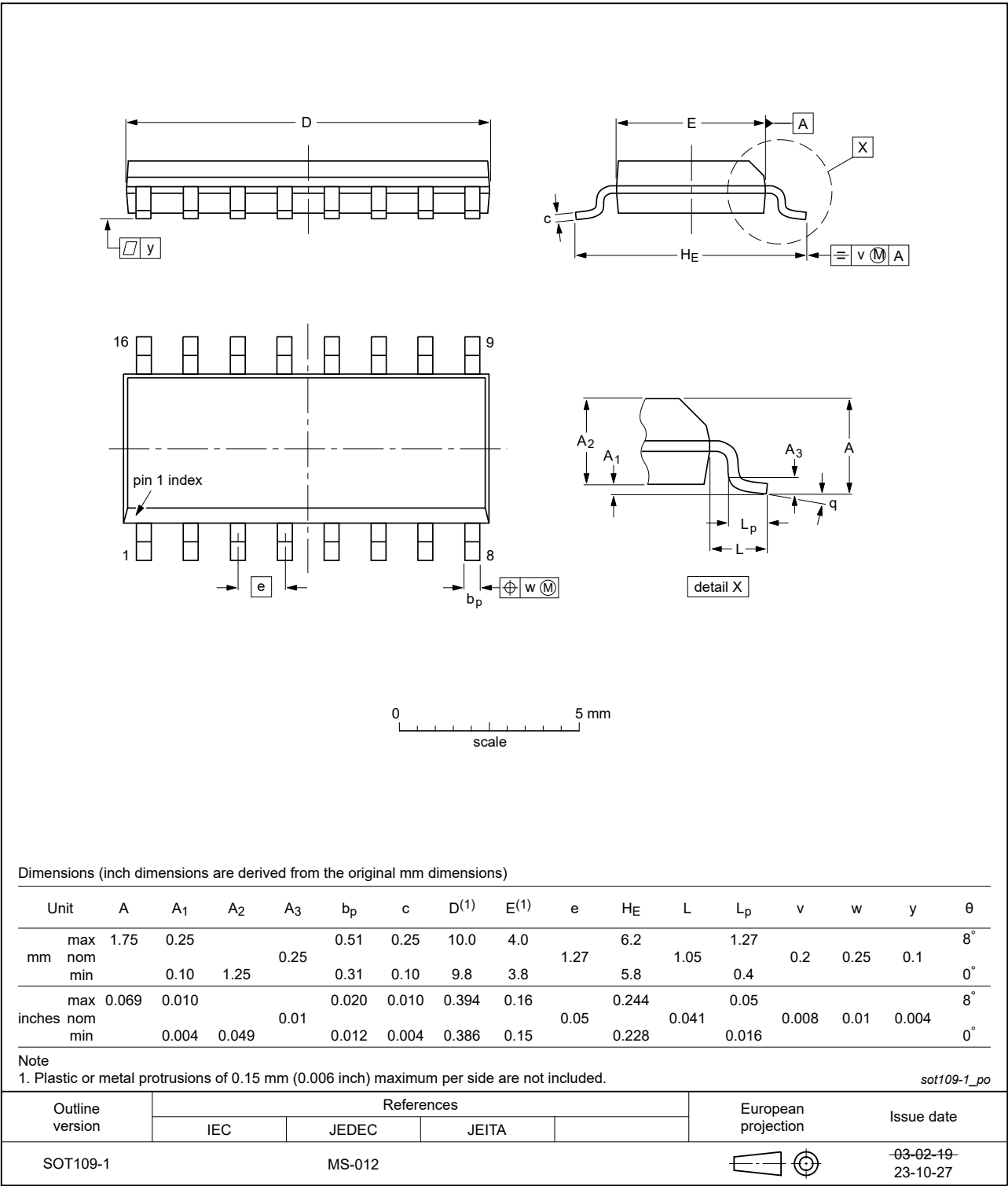


Fig. 8. Package outline SOT109-1 (SO16)



12. Abbreviations

Table 11. 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             |

13. Revision history

Table 12. Revision history

| Document ID         | Release date                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Data sheet status     | Change notice | Supersedes          |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|---------------------|
| 74HC_HCT390 v.6     | 20240319                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Product data sheet    | -             | 74HC_HCT390 v.5     |
| Modifications:      | <ul style="list-style-type: none"><li><a href="#">Fig. 8</a>, <a href="#">Fig. 9</a>: Aligned SO and TSSOP package outline drawings to JEDEC MS-012 and MO-153.</li><li><a href="#">Section 2</a>: ESD specification updated according to the latest JEDEC standard.</li></ul>                                                                                                                                                                                  |                       |               |                     |
| 74HC_HCT390 v.5     | 20211018                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Product data sheet    | -             | 74HC_HCT390 v.4     |
| Modifications:      | <ul style="list-style-type: none"><li>Type number 74HCT390PW (SOT403-1 / TSSOP16) added.</li></ul>                                                                                                                                                                                                                                                                                                                                                              |                       |               |                     |
| 74HC_HCT390 v.4     | 20200821                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Product data sheet    | -             | 74HC_HCT390 v.3     |
| 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 numbers 74HC390DB and 74HCT390DB (SOT338-1) removed.</li><li><a href="#">Table 1</a>: typo corrected.</li><li><a href="#">Table 5</a>: Derating values for P<sub>tot</sub> total power dissipation updated.</li></ul> |                       |               |                     |
| 74HC_HCT390 v.3     | 20160816                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Product data sheet    | -             | 74HC_HCT390_CNV v.2 |
| 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><li>Type numbers 74HC390N and 74HCT390N removed.</li></ul>                                                                                                                                                       |                       |               |                     |
| 74HC_HCT390_CNV v.2 | 19901201                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Product specification | -             | -                   |

## 14. Legal information

### Data sheet status

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

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
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