

# 74HC393; 74HCT393

## Dual 4-bit binary ripple counter

Rev. 9 — 19 March 2024

Product data sheet

### 1. General description

The 74HC393; 74HCT393 is a dual 4-stage binary ripple counter. Each counter features a clock input ( $\overline{nCP}$ ), an overriding asynchronous master reset input ( $\overline{nMR}$ ) and 4 buffered parallel outputs ( $nQ0$  to  $nQ3$ ). The counter advances on the HIGH-to-LOW transition of  $\overline{nCP}$ . A HIGH on  $\overline{nMR}$  clears the counter stages and forces the outputs LOW, independent of the state of  $\overline{nCP}$ . 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

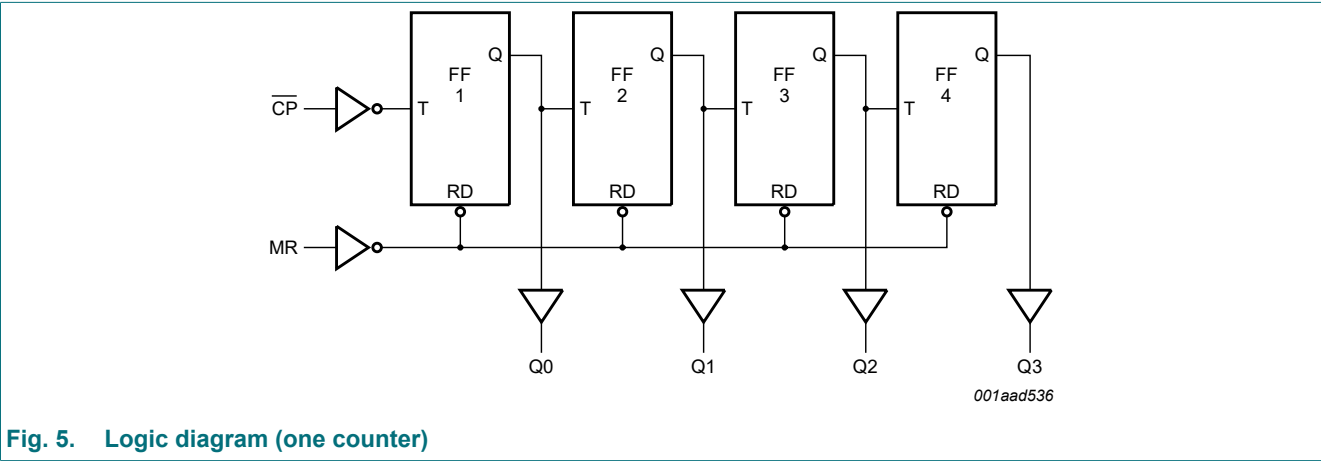
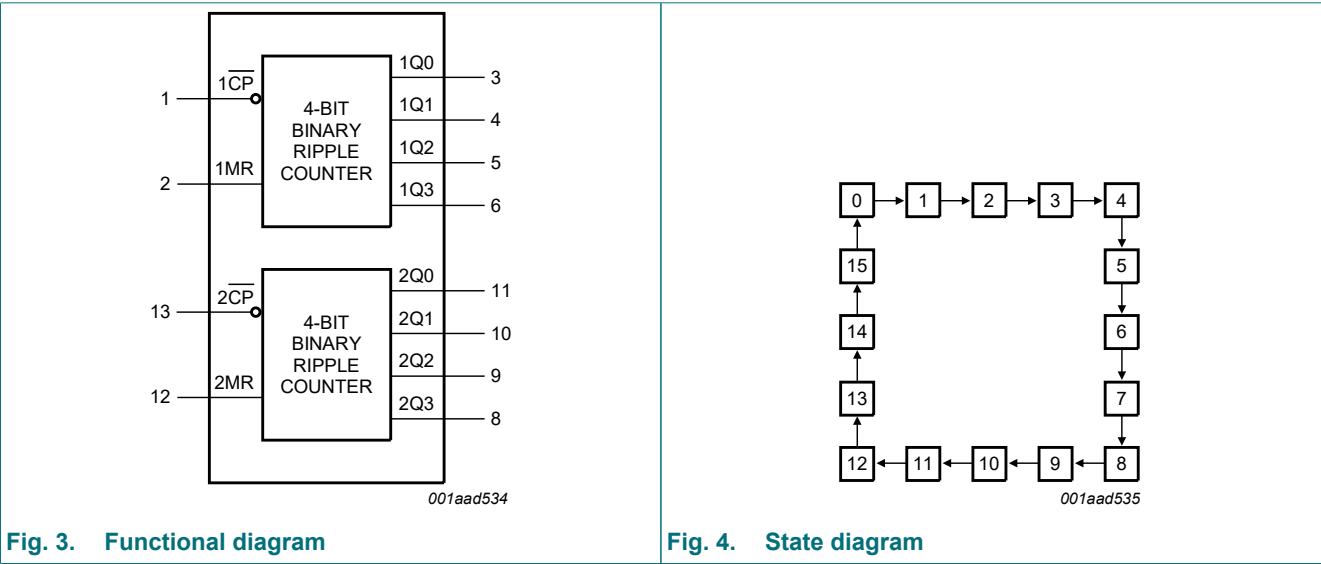
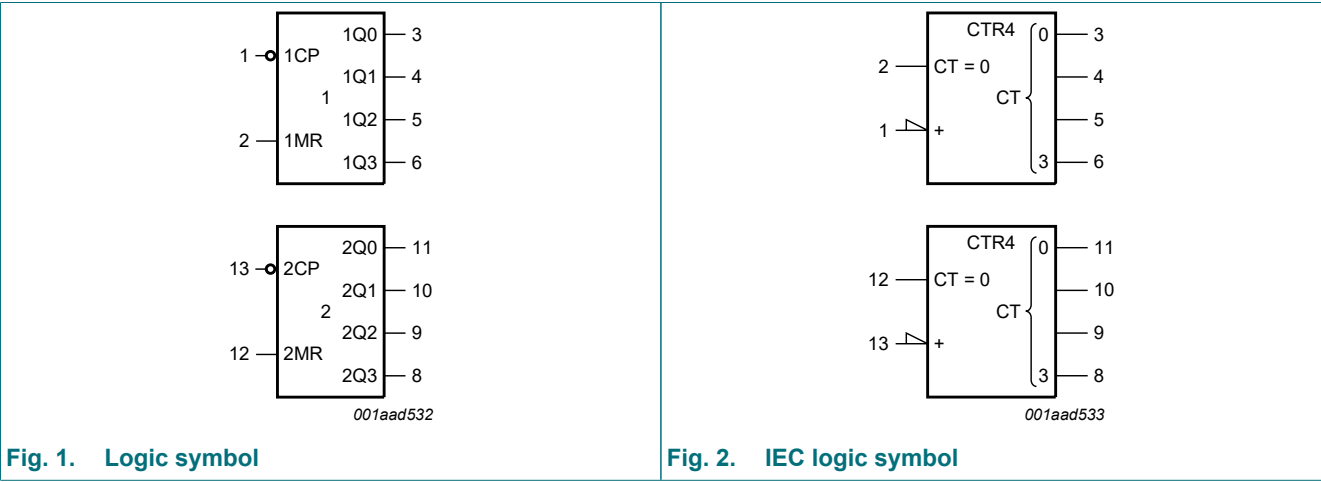
- Wide supply voltage range from 2.0 V to 6.0 V
- CMOS low power dissipation
- High noise immunity
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Complies with JEDEC standards:
  - JESD8C (2.7 V to 3.6 V)
  - JESD7A (2.0 V to 6.0 V)
- Input levels:
  - For 74HC393: CMOS level
  - For 74HCT393: TTL level
- ESD protection:
  - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
  - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Two 4-bit binary counters with individual clocks
- Divide by any binary module up to 28 in one package
- Two master resets to clear each 4-bit counter individually

### 3. Ordering information

Table 1. Ordering information

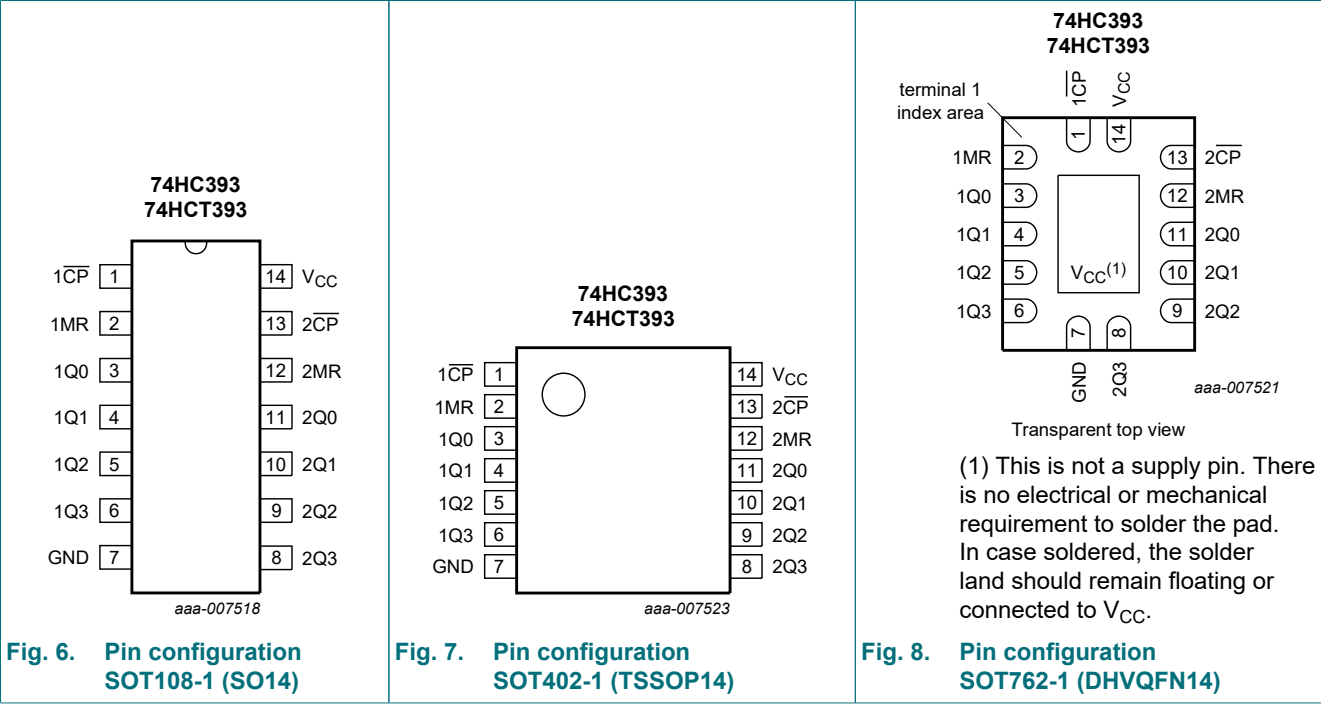
| Type number                | Package           |          |                                                                                                                                    |                          |
|----------------------------|-------------------|----------|------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
|                            | Temperature range | Name     | Description                                                                                                                        | Version                  |
| <a href="#">74HC393D</a>   | -40 °C to +125 °C | SO14     | plastic small outline package; 14 leads;<br>body width 3.9 mm                                                                      | <a href="#">SOT108-1</a> |
| <a href="#">74HCT393D</a>  |                   |          |                                                                                                                                    |                          |
| <a href="#">74HC393PW</a>  | -40 °C to +125 °C | TSSOP14  | plastic thin shrink small outline package; 14 leads;<br>body width 4.4 mm                                                          | <a href="#">SOT402-1</a> |
| <a href="#">74HCT393PW</a> |                   |          |                                                                                                                                    |                          |
| <a href="#">74HC393BQ</a>  | -40 °C to +125 °C | DHVQFN14 | plastic dual in-line compatible thermal enhanced<br>very thin quad flat package; no leads; 14 terminals;<br>body 2.5 × 3 × 0.85 mm | <a href="#">SOT762-1</a> |
| <a href="#">74HCT393BQ</a> |                   |          |                                                                                                                                    |                          |

4. Functional diagram



5. Pinning information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

| Symbol             | Pin          | Description                                   |
|--------------------|--------------|-----------------------------------------------|
| 1CP                | 1            | clock input (HIGH-to-LOW, edge-triggered)     |
| 1MR                | 2            | asynchronous master reset input (active HIGH) |
| 1Q0, 1Q1, 1Q2, 1Q3 | 3, 4, 5, 6   | flip-flop output                              |
| GND                | 7            | ground (0 V)                                  |
| 2Q3, 2Q2, 2Q1, 2Q0 | 8, 9, 10, 11 | flip-flop output                              |
| 2MR                | 12           | asynchronous master reset input (active HIGH) |
| 2CP                | 13           | clock input (HIGH-to-LOW, edge-triggered)     |
| V <sub>CC</sub>    | 14           | supply voltage                                |

## 6. Functional description

**Table 3. Count sequence for one counter**  
*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   |
| 10    | L      | H   | L   | H   |
| 11    | H      | H   | L   | H   |
| 12    | L      | L   | H   | H   |
| 13    | H      | L   | H   | H   |
| 14    | L      | H   | H   | H   |
| 15    | H      | H   | H   | H   |

## 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 <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          | V <sub>O</sub> = -0.5 V to 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 SOT108-1 (SO14) package: P<sub>tot</sub> derates linearly with 10.1 mW/K above 100 °C.  
For SOT402-1 (TSSOP14) package: P<sub>tot</sub> derates linearly with 7.3 mW/K above 81 °C.  
For SOT762-1 (DHVQFN14) package: P<sub>tot</sub> derates linearly with 9.6 mW/K above 98 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V)

| Symbol           | Parameter                           | Conditions              | 74HC393 |      |                 | 74HCT393 |      |                 | 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 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  |      |
| 74HC393         |                           |                                                                                        |       |      |      |                  |      |                   |      |      |
| V <sub>IH</sub> | HIGH-level input voltage  | V <sub>CC</sub> = 2.0 V                                                                | 1.5   | 1.2  | -    | 1.5              | -    | 1.5               | -    | V    |
|                 |                           | V <sub>CC</sub> = 4.5 V                                                                | 3.15  | 2.4  | -    | 3.15             | -    | 3.15              | -    | V    |
|                 |                           | V <sub>CC</sub> = 6.0 V                                                                | 4.2   | 3.2  | -    | 4.2              | -    | 4.2               | -    | V    |
| V <sub>IL</sub> | LOW-level input voltage   | V <sub>CC</sub> = 2.0 V                                                                | -     | 0.8  | 0.5  | -                | 0.5  | -                 | 0.5  | V    |
|                 |                           | V <sub>CC</sub> = 4.5 V                                                                | -     | 2.1  | 1.35 | -                | 1.35 | -                 | 1.35 | V    |
|                 |                           | V <sub>CC</sub> = 6.0 V                                                                | -     | 2.8  | 1.8  | -                | 1.8  | -                 | 1.8  | V    |
| V <sub>OH</sub> | HIGH-level output voltage | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                    |       |      |      |                  |      |                   |      |      |
|                 |                           | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 2.0 V                                       | 1.9   | 2.0  | -    | 1.9              | -    | 1.9               | -    | V    |
|                 |                           | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 4.5 V                                       | 4.4   | 4.5  | -    | 4.4              | -    | 4.4               | -    | V    |
|                 |                           | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 6.0 V                                       | 5.9   | 6.0  | -    | 5.9              | -    | 5.9               | -    | V    |
|                 |                           | I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V                                      | 3.98  | 4.32 | -    | 3.84             | -    | 3.7               | -    | V    |
|                 |                           | I <sub>O</sub> = -5.2 mA; V <sub>CC</sub> = 6.0 V                                      | 5.48  | 5.81 | -    | 5.34             | -    | 5.2               | -    | V    |
| V <sub>OL</sub> | LOW-level output voltage  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                    |       |      |      |                  |      |                   |      |      |
|                 |                           | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 2.0 V                                        | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V                                        | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V                                        | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V                                       | -     | 0.15 | 0.26 | -                | 0.33 | -                 | 0.4  | V    |
|                 |                           | I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V                                       | -     | 0.16 | 0.26 | -                | 0.33 | -                 | 0.4  | V    |
| I <sub>I</sub>  | input leakage current     | V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V                       | -     | -    | ±0.1 | -                | ±1.0 | -                 | ±1.0 | μA   |
| I <sub>CC</sub> | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 6.0 V | -     | -    | 8.0  | -                | 80   | -                 | 160  | μA   |
| C <sub>I</sub>  | input capacitance         |                                                                                        | -     | 3.5  | -    | -                | -    | -                 | -    | pF   |

| Symbol           | Parameter                 | Conditions                                                                                                                               | 25 °C |      |      | -40 °C to +85 °C |      | -40 °C to +125 °C |      | Unit |
|------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------|-------|------|------|------------------|------|-------------------|------|------|
|                  |                           |                                                                                                                                          | Min   | Typ  | Max  | Min              | Max  | Min               | Max  |      |
| 74HCT393         |                           |                                                                                                                                          |       |      |      |                  |      |                   |      |      |
| V <sub>IH</sub>  | HIGH-level input voltage  | V <sub>CC</sub> = 4.5 V to 5.5 V                                                                                                         | 2.0   | 1.6  | -    | 2.0              | -    | 2.0               | -    | V    |
| V <sub>IL</sub>  | LOW-level input voltage   | V <sub>CC</sub> = 4.5 V to 5.5 V                                                                                                         | -     | 1.2  | 0.8  | -                | 0.8  | -                 | 0.8  | V    |
| V <sub>OH</sub>  | HIGH-level output voltage | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V                                                            |       |      |      |                  |      |                   |      |      |
|                  |                           | I <sub>O</sub> = -20 µA                                                                                                                  | 4.4   | 4.5  | -    | 4.4              | -    | 4.4               | -    | V    |
|                  |                           | I <sub>O</sub> = -4 mA                                                                                                                   | 3.98  | 4.32 | -    | 3.84             | -    | 3.7               | -    | V    |
| V <sub>OL</sub>  | LOW-level output voltage  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V                                                            |       |      |      |                  |      |                   |      |      |
|                  |                           | I <sub>O</sub> = 20 µA                                                                                                                   | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                  |                           | I <sub>O</sub> = 4.0 mA                                                                                                                  | -     | 0.15 | 0.26 | -                | 0.33 | -                 | 0.4  | V    |
| I <sub>I</sub>   | input leakage current     | V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V                                                                         | -     | -    | ±0.1 | -                | ±1.0 | -                 | ±1.0 | µA   |
| I <sub>CC</sub>  | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V                                                   | -     | -    | 8.0  | -                | 80   | -                 | 160  | µA   |
| ΔI <sub>CC</sub> | additional supply current | 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; I <sub>O</sub> = 0 A |       |      |      |                  |      |                   |      |      |
|                  |                           | per input pin; nCP                                                                                                                       | -     | 40   | 144  | -                | 180  | -                 | 196  | µA   |
|                  |                           | per input pin; nMR                                                                                                                       | -     | 100  | 360  | -                | 450  | -                 | 490  | µA   |
| C <sub>I</sub>   | input capacitance         |                                                                                                                                          | -     | 3.5  | -    | -                | -    | -                 | -    | pF   |

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); C<sub>L</sub> = 50 pF unless otherwise specified; for test circuit see Fig. 11.

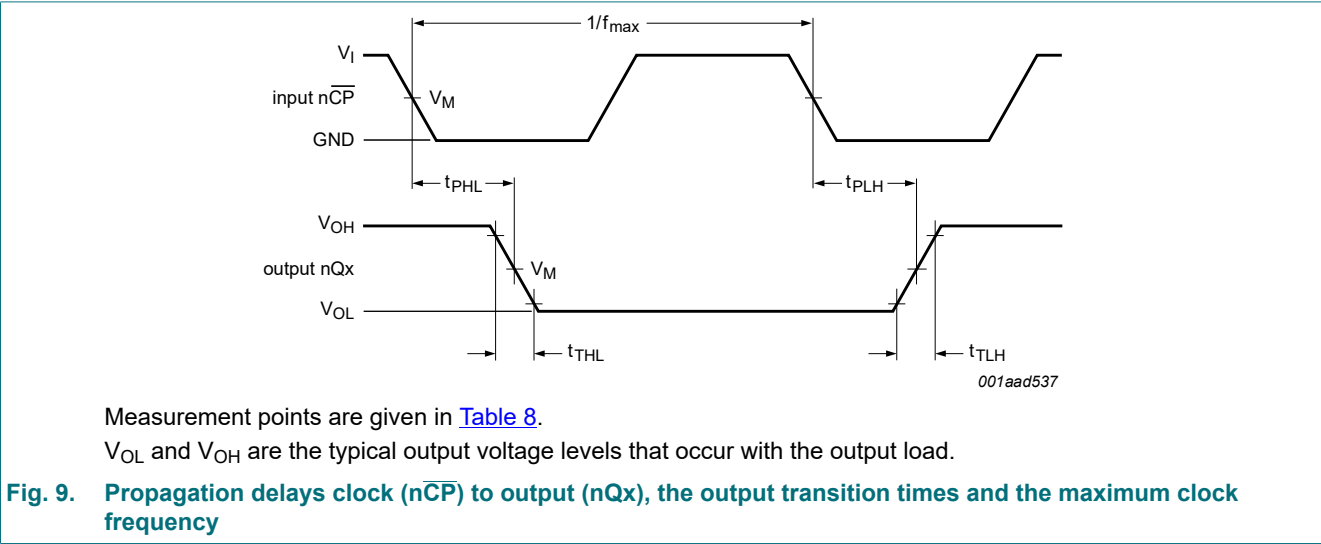
| Symbol          | Parameter         | Conditions                                      | 25 °C |     |     | -40 °C to +85 °C |     | -40 °C to +125 °C |     | Unit |
|-----------------|-------------------|-------------------------------------------------|-------|-----|-----|------------------|-----|-------------------|-----|------|
|                 |                   |                                                 | Min   | Typ | Max | Min              | Max | Min               | Max |      |
| 74HC393         |                   |                                                 |       |     |     |                  |     |                   |     |      |
| t <sub>pd</sub> | propagation delay | n $\overline{\text{CP}}$ to nQ0; see Fig. 9 [1] |       |     |     |                  |     |                   |     |      |
|                 |                   | V <sub>CC</sub> = 2.0 V                         | -     | 41  | 125 | -                | 155 | -                 | 190 | ns   |
|                 |                   | V <sub>CC</sub> = 4.5 V                         | -     | 15  | 25  | -                | 31  | -                 | 38  | ns   |
|                 |                   | V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF   | -     | 12  | -   | -                | -   | -                 | -   | ns   |
|                 |                   | V <sub>CC</sub> = 6.0 V                         | -     | 12  | 21  | -                | 26  | -                 | 32  | ns   |
|                 |                   | nQx to nQ(x+1); see Fig. 9 [1]                  |       |     |     |                  |     |                   |     |      |
|                 |                   | V <sub>CC</sub> = 2.0 V                         | -     | 14  | 45  | -                | 55  | -                 | 70  | ns   |
|                 |                   | V <sub>CC</sub> = 4.5 V                         | -     | 5   | 9   | -                | 11  | -                 | 14  | ns   |
|                 |                   | V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF   | -     | 5   | -   | -                | -   | -                 | -   | ns   |
|                 |                   | V <sub>CC</sub> = 6.0 V                         | -     | 4   | 8   | -                | 9   | -                 | 12  | ns   |

| Symbol                | Parameter                     | Conditions                                                                     | 25 °C |     |     | -40 °C to +85 °C |     | -40 °C to +125 °C |     | Unit |
|-----------------------|-------------------------------|--------------------------------------------------------------------------------|-------|-----|-----|------------------|-----|-------------------|-----|------|
|                       |                               |                                                                                | Min   | Typ | Max | Min              | Max | Min               | Max |      |
| t <sub>PHL</sub>      | HIGH to LOW propagation delay | nMR to nQx; see Fig. 10                                                        |       |     |     |                  |     |                   |     |      |
|                       |                               | V <sub>CC</sub> = 2.0 V                                                        | -     | 39  | 140 | -                | 175 | -                 | 210 | ns   |
|                       |                               | V <sub>CC</sub> = 4.5 V                                                        | -     | 14  | 28  | -                | 35  | -                 | 42  | ns   |
|                       |                               | V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF                                  | -     | 11  | -   | -                | -   | -                 | -   | ns   |
|                       |                               | V <sub>CC</sub> = 6.0 V                                                        | -     | 11  | 24  | -                | 30  | -                 | 36  | ns   |
| t <sub>t</sub>        | transition time               | Qn; see Fig. 9 [2]                                                             |       |     |     |                  |     |                   |     |      |
|                       |                               | V <sub>CC</sub> = 2.0 V                                                        | -     | 19  | 75  | -                | 95  | -                 | 110 | ns   |
|                       |                               | V <sub>CC</sub> = 4.5 V                                                        | -     | 7   | 15  | -                | 19  | -                 | 22  | ns   |
|                       |                               | V <sub>CC</sub> = 6.0 V                                                        | -     | 6   | 13  | -                | 16  | -                 | 19  | ns   |
| t <sub>W</sub>        | pulse width                   | nCP HIGH or LOW; see Fig. 9                                                    |       |     |     |                  |     |                   |     |      |
|                       |                               | V <sub>CC</sub> = 2.0 V                                                        | 80    | 17  | -   | 100              | -   | 120               | -   | ns   |
|                       |                               | V <sub>CC</sub> = 4.5 V                                                        | 16    | 6   | -   | 20               | -   | 24                | -   | ns   |
|                       |                               | V <sub>CC</sub> = 6.0 V                                                        | 14    | 5   | -   | 17               | -   | 20                | -   | ns   |
|                       |                               | nMR HIGH; see Fig. 10                                                          |       |     |     |                  |     |                   |     |      |
|                       |                               | 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   |
| t <sub>rec</sub>      | recovery time                 | nMR to nCP; see Fig. 10                                                        |       |     |     |                  |     |                   |     |      |
|                       |                               | V <sub>CC</sub> = 2.0 V                                                        | 5     | 3   | -   | 5                | -   | 5                 | -   | ns   |
|                       |                               | V <sub>CC</sub> = 4.5 V                                                        | 5     | 1   | -   | 5                | -   | 5                 | -   | ns   |
|                       |                               | V <sub>CC</sub> = 6.0 V                                                        | 5     | 1   | -   | 5                | -   | 5                 | -   | ns   |
| f <sub>clk(max)</sub> | maximum clock frequency       | see Fig. 9                                                                     |       |     |     |                  |     |                   |     |      |
|                       |                               | V <sub>CC</sub> = 2.0 V                                                        | 6     | 30  | -   | 5                | -   | 4                 | -   | MHz  |
|                       |                               | V <sub>CC</sub> = 4.5 V                                                        | 30    | 90  | -   | 24               | -   | 20                | -   | MHz  |
|                       |                               | V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF                                  | -     | 99  | -   | -                | -   | -                 | -   | MHz  |
|                       |                               | V <sub>CC</sub> = 6.0 V                                                        | 35    | 107 | -   | 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> [3] | -     | 23  | -   | -                | -   | -                 | -   | pF   |
| 74HCT393              |                               |                                                                                |       |     |     |                  |     |                   |     |      |
| t <sub>pd</sub>       | propagation delay             | nCP to nQ0; see Fig. 9 [1]                                                     |       |     |     |                  |     |                   |     |      |
|                       |                               | V <sub>CC</sub> = 4.5 V                                                        | -     | 15  | 25  | -                | 31  | -                 | 38  | ns   |
|                       |                               | V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF                                  | -     | 20  | -   | -                | -   | -                 | -   | ns   |
|                       |                               | nQx to nQ(x+1); see Fig. 9 [1]                                                 |       |     |     |                  |     |                   |     |      |
|                       |                               | V <sub>CC</sub> = 4.5 V                                                        | -     | 6   | 10  | -                | 13  | -                 | 15  | ns   |
|                       |                               | V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF                                  | -     | 6   | -   | -                | -   | -                 | -   | ns   |
| t <sub>PHL</sub>      | HIGH to LOW propagation delay | nMR to nQx; see Fig. 10                                                        |       |     |     |                  |     |                   |     |      |
|                       |                               | V <sub>CC</sub> = 4.5 V                                                        | -     | 18  | 32  | -                | 40  | -                 | 48  | ns   |
|                       |                               | V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF                                  | -     | 15  | -   | -                | -   | -                 | -   | ns   |
| t <sub>t</sub>        | transition time               | Qn; see Fig. 9 [2]                                                             |       |     |     |                  |     |                   |     |      |
|                       |                               | V <sub>CC</sub> = 4.5 V                                                        | -     | 7   | 15  | -                | 19  | -                 | 22  | ns   |

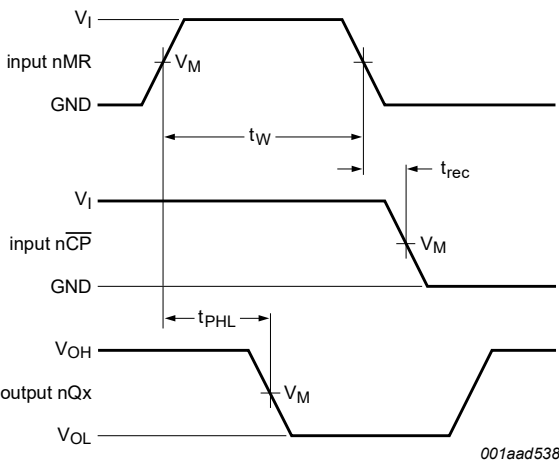
| Symbol                | Parameter                     | Conditions                                                                             | 25 °C |     |     | -40 °C to +85 °C |     | -40 °C to +125 °C |     | Unit |
|-----------------------|-------------------------------|----------------------------------------------------------------------------------------|-------|-----|-----|------------------|-----|-------------------|-----|------|
|                       |                               |                                                                                        | Min   | Typ | Max | Min              | Max | Min               | Max |      |
| t <sub>W</sub>        | pulse width                   | nCP HIGH or LOW; see Fig. 9                                                            |       |     |     |                  |     |                   |     |      |
|                       |                               | V <sub>CC</sub> = 4.5 V                                                                | 19    | 11  | -   | 24               | -   | 29                | -   | ns   |
|                       |                               | nMR HIGH; see Fig. 10                                                                  |       |     |     |                  |     |                   |     |      |
|                       |                               | V <sub>CC</sub> = 4.5 V                                                                | 16    | 6   | -   | 20               | -   | 24                | -   | ns   |
| t <sub>rec</sub>      | recovery time                 | nMR to nCP; see Fig. 10                                                                |       |     |     |                  |     |                   |     |      |
|                       |                               | V <sub>CC</sub> = 4.5 V                                                                | 5     | 0   | -   | 5                | -   | 5                 | -   | ns   |
| f <sub>clk(max)</sub> | maximum clock frequency       | see Fig. 9                                                                             |       |     |     |                  |     |                   |     |      |
|                       |                               | V <sub>CC</sub> = 4.5 V                                                                | 27    | 48  | -   | 22               | -   | 18                | -   | MHz  |
|                       |                               | V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF                                          | -     | 53  | -   | -                | -   | -                 | -   | 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 [3] | -     | 25  | -   | -                | -   | -                 | -   | pF   |

- [1] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.
- [2] t<sub>t</sub> is the same as t<sub>THL</sub> and t<sub>TLH</sub>.
- [3] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$  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;  
 $\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.

10.1. Waveforms and test circuit





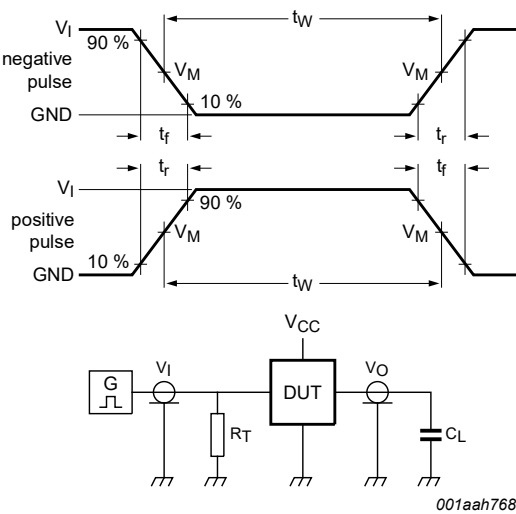


Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are the typical output voltage levels that occur with the output load.

**Fig. 10. Propagation delays clock (nCP) to output (nQx), pulse width master reset (nMR), and recovery time master reset (nMR) to clock (nCP)**

**Table 8. Measurement points**

| Type     | Input              |  | Output             |
|----------|--------------------|--|--------------------|
|          | $V_M$              |  | $V_M$              |
| 74HC393  | 0.5V <sub>CC</sub> |  | 0.5V <sub>CC</sub> |
| 74HCT393 | 1.3 V              |  | 1.3 V              |



Test data is given in [Table 9](#).  
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. 11. Test circuit for measuring switching times**

**Table 9. Test data**

| Type     | Input    |            | Load         | Test               |
|----------|----------|------------|--------------|--------------------|
|          | $V_I$    | $t_r, t_f$ | $C_L$        |                    |
| 74HC393  | $V_{CC}$ | 6.0 ns     | 15 pF, 50 pF | $t_{PLH}, t_{PHL}$ |
| 74HCT393 | 3.0 V    | 6.0 ns     | 15 pF, 50 pF | $t_{PLH}, t_{PHL}$ |

11. Package outline

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

SOT108-1

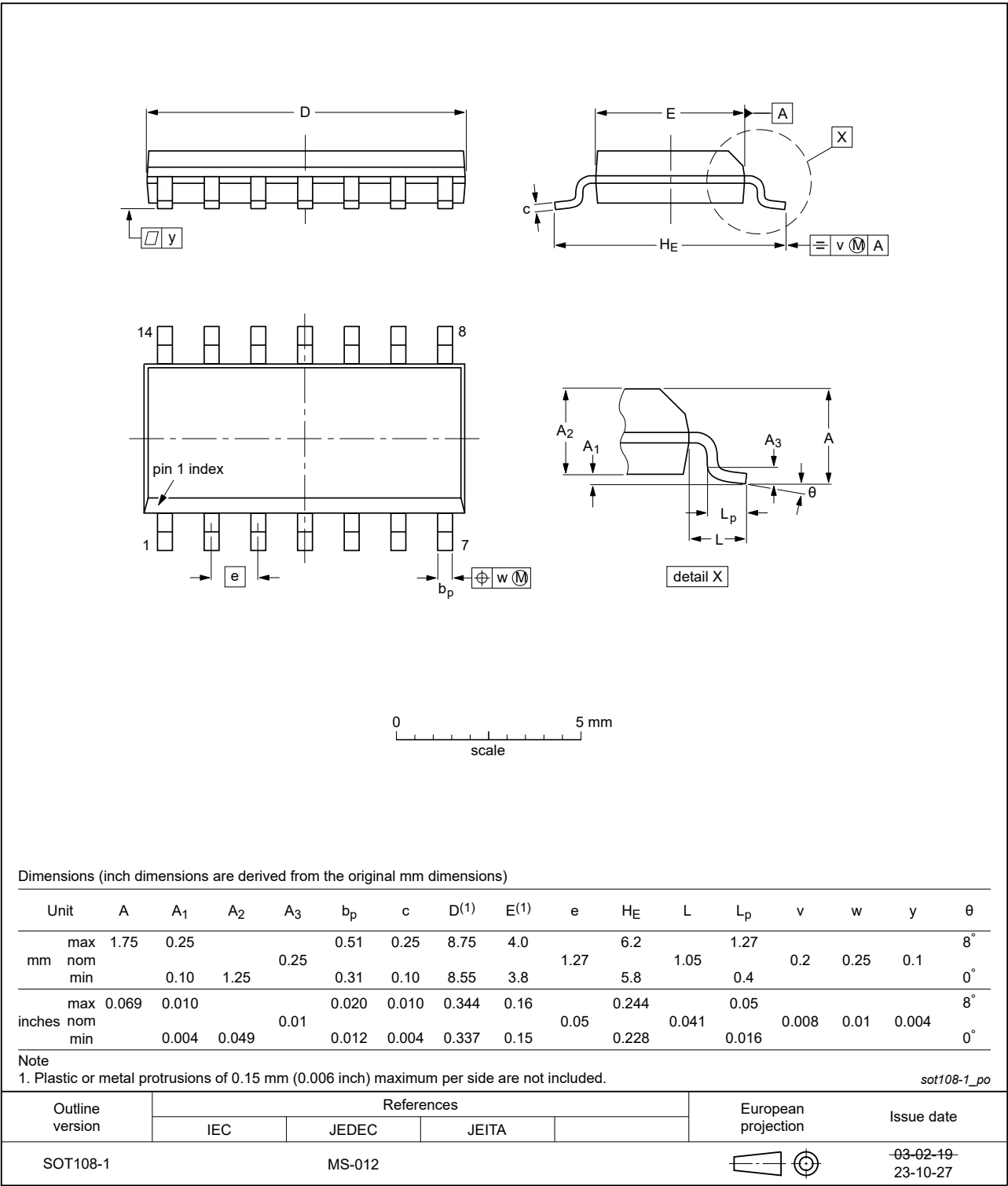


Fig. 12. Package outline SOT108-1 (SO14)

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

SOT402-1

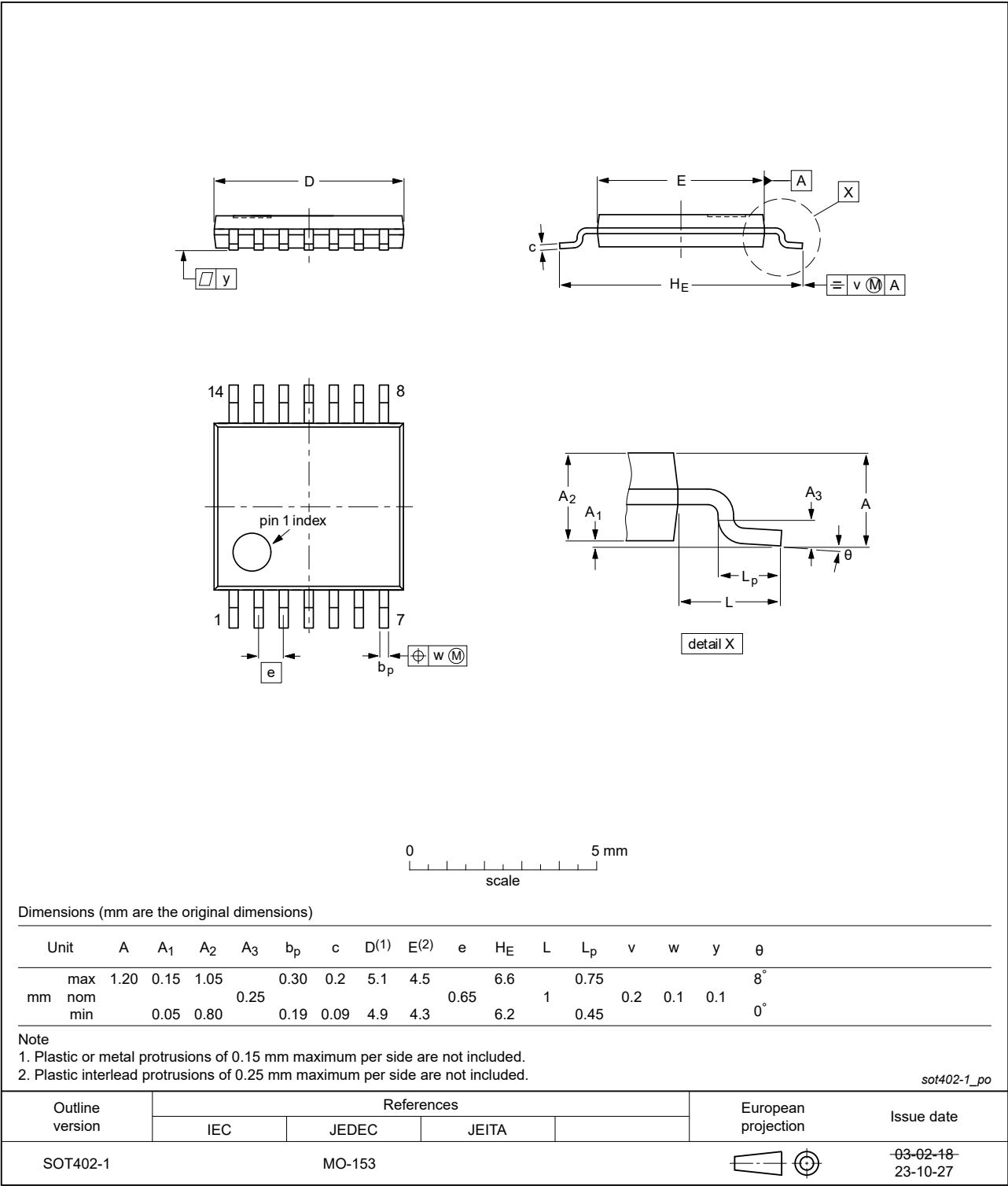


Fig. 13. Package outline SOT402-1 (TSSOP14)

DHVQFN14: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads;  
 14 terminals; body 2.5 x 3 x 0.85 mm

SOT762-1

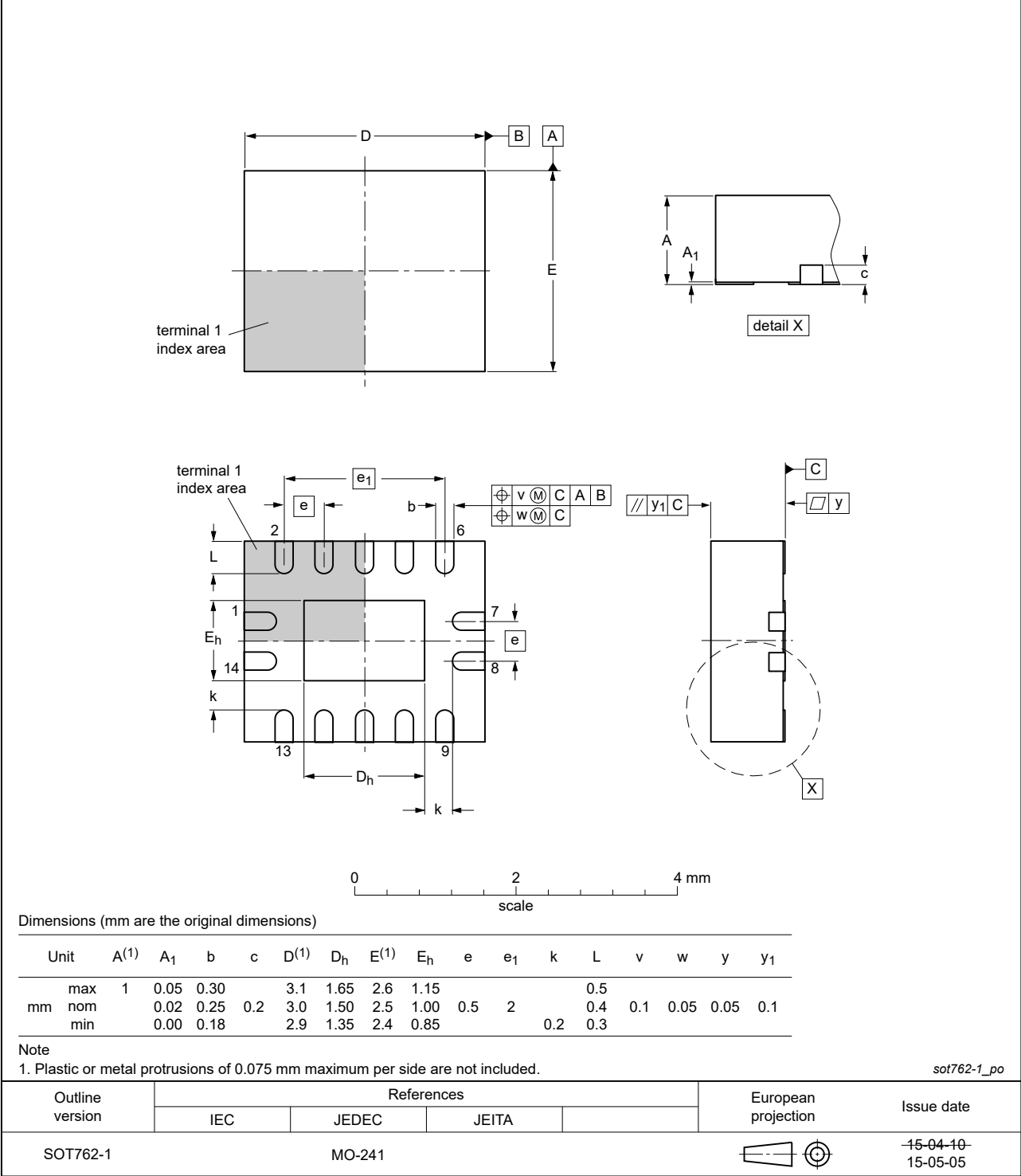


Fig. 14. Package outline SOT762-1 (DHVQFN14)

12. Abbreviations

Table 10. Abbreviations

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

13. Revision history

Table 11. Revision history

| Document ID         | Release date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Data sheet status     | Change notice | Supersedes          |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|---------------------|
| 74HC_HCT393 v.9     | 20240319                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Product data sheet    | -             | 74HC_HCT393 v.8     |
| Modifications:      | <ul style="list-style-type: none"><li><a href="#">Fig. 12</a>, <a href="#">Fig. 13</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_HCT393 v.8     | 20211022                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Product data sheet    | -             | 74HC_HCT393 v.7.1   |
| Modifications:      | <ul style="list-style-type: none"><li><a href="#">Table 6</a>: <math>V_{OH}</math> and <math>V_{OL}</math> conditions for 74HCT393 corrected. (Errata)</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                       |               |                     |
| 74HC_HCT393 v.7.1   | 20201021                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Product data sheet    | -             | 74HC_HCT393 v.6     |
| 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 74HC393DB and 74HCT393DB (SOT337-1/SSOP14) removed.</li><li><a href="#">Section 1</a> (Errata) and <a href="#">Section 2</a> updated.</li><li><a href="#">Table 4</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li><li>v.7.1: <a href="#">Table 6</a>: Values input leakage current for 74HC393 aligned with 74HCT393. (Errata)</li></ul> |                       |               |                     |
| 74HC_HCT393 v.6     | 20151203                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Product data sheet    | -             | 74HC_HCT393 v.5     |
| Modifications:      | <ul style="list-style-type: none"><li>Type numbers 74HC393N and 74HCT393N (SOT27-1) removed.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                       |               |                     |
| 74HC_HCT393 v.5     | 20140401                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Product data sheet    | -             | 74HC_HCT393 v.4     |
| Modifications:      | <ul style="list-style-type: none"><li><a href="#">Table 7</a>: The conditions for <math>C_{PD}</math> have been corrected (errata).</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                       |               |                     |
| 74HC_HCT393 v.4     | 20130516                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Product data sheet    | -             | 74HC_HCT393 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_HCT393 v.3     | 20050906                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Product data sheet    | -             | 74HC_HCT393_CNV v.2 |
| 74HC_HCT393_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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