

# 74LVC161

## Presettable synchronous 4-bit binary counter; asynchronous reset

Rev. 9 — 12 February 2024

Product data sheet

### 1. General description

The 74LVC161 is a synchronous presettable binary counter with an internal look-ahead carry. Synchronous operation is provided by having all flip-flops clocked simultaneously on the positive-going edge of the clock (CP). The outputs (Q0 to Q3) of the counters may be preset HIGH or LOW. A LOW at the parallel enable input (PE) disables the counting action and causes the data at the data inputs (D0 to D3) to be loaded into the counter on the positive-going edge of the clock. Preset takes place regardless of the levels at count enable inputs (CEP and CET). A LOW at the master reset input ( $\overline{MR}$ ) sets Q0 to Q3 LOW regardless of the levels at input pins CP, PE, CET and CEP (thus providing an asynchronous clear function). The look-ahead carry simplifies serial cascading of the counters. Both CEP and CET must be HIGH to count. The CET input is fed forward to enable the terminal count output (TC). The TC output thus enabled will produce a HIGH output pulse of a duration approximately equal to a HIGH output of Q0. This pulse can be used to enable the next cascaded stage.

Inputs can be driven from either 3.3 V or 5 V devices. This feature allows the use of these devices as translators in mixed 3.3 V and 5 V environments.

Schmitt-trigger action at all inputs makes the circuit tolerant of slower input rise and fall times.

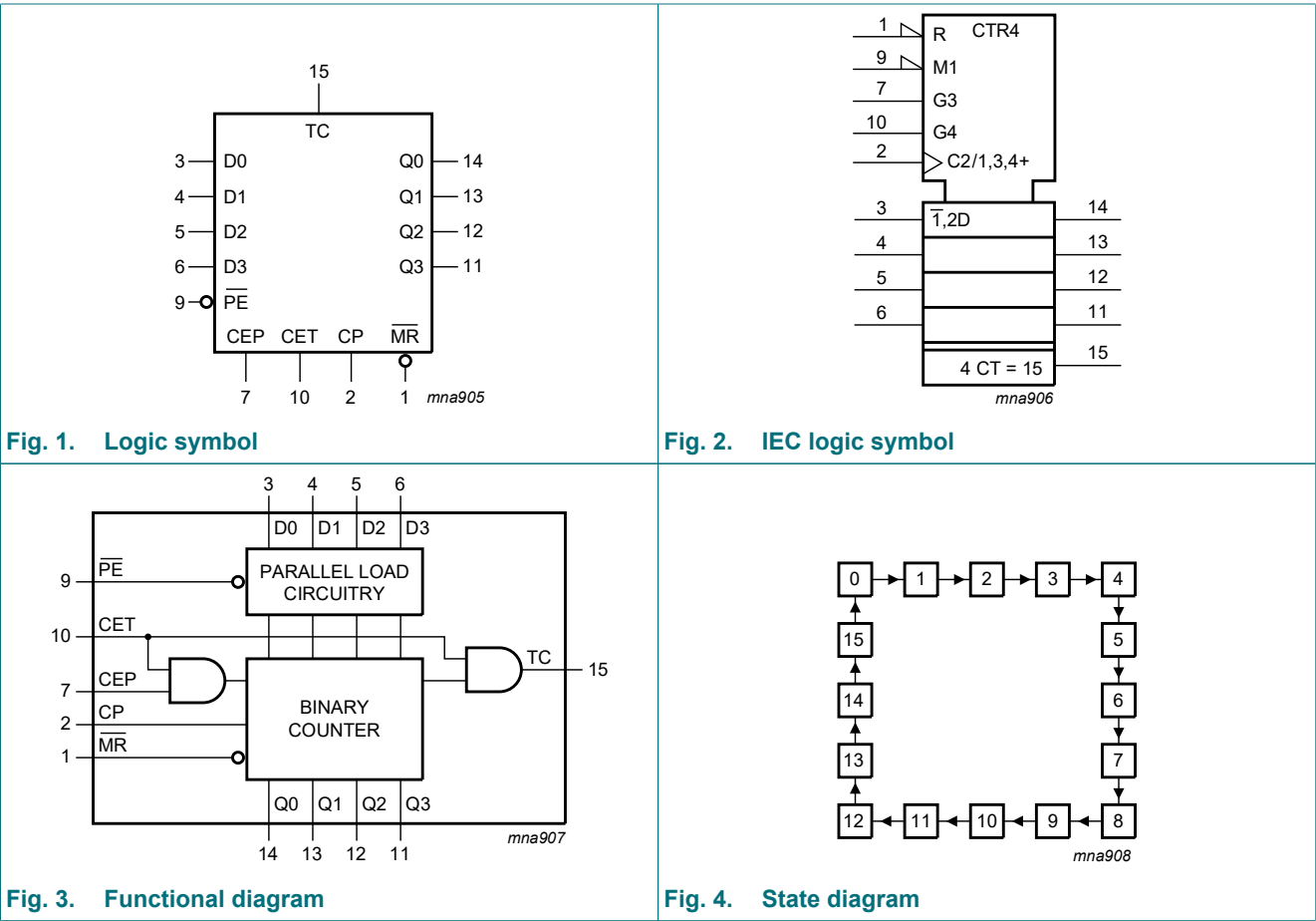
### 2. Features and benefits

- Overvoltage tolerant inputs to 5.5 V
- Wide supply voltage range from 1.2 V to 3.6 V
- CMOS low power dissipation
- Direct interface with TTL levels
- Asynchronous reset
- Synchronous counting and loading
- Two count enable inputs for n-bit cascading
- Positive edge-triggered clock
- Complies with JEDEC standard:
  - JESD8-7A (1.65 V to 1.95 V)
  - JESD8-5A (2.3 V to 2.7 V)
  - JESD8-C/JESD36 (2.7 V to 3.6 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 -40 °C to +125 °C

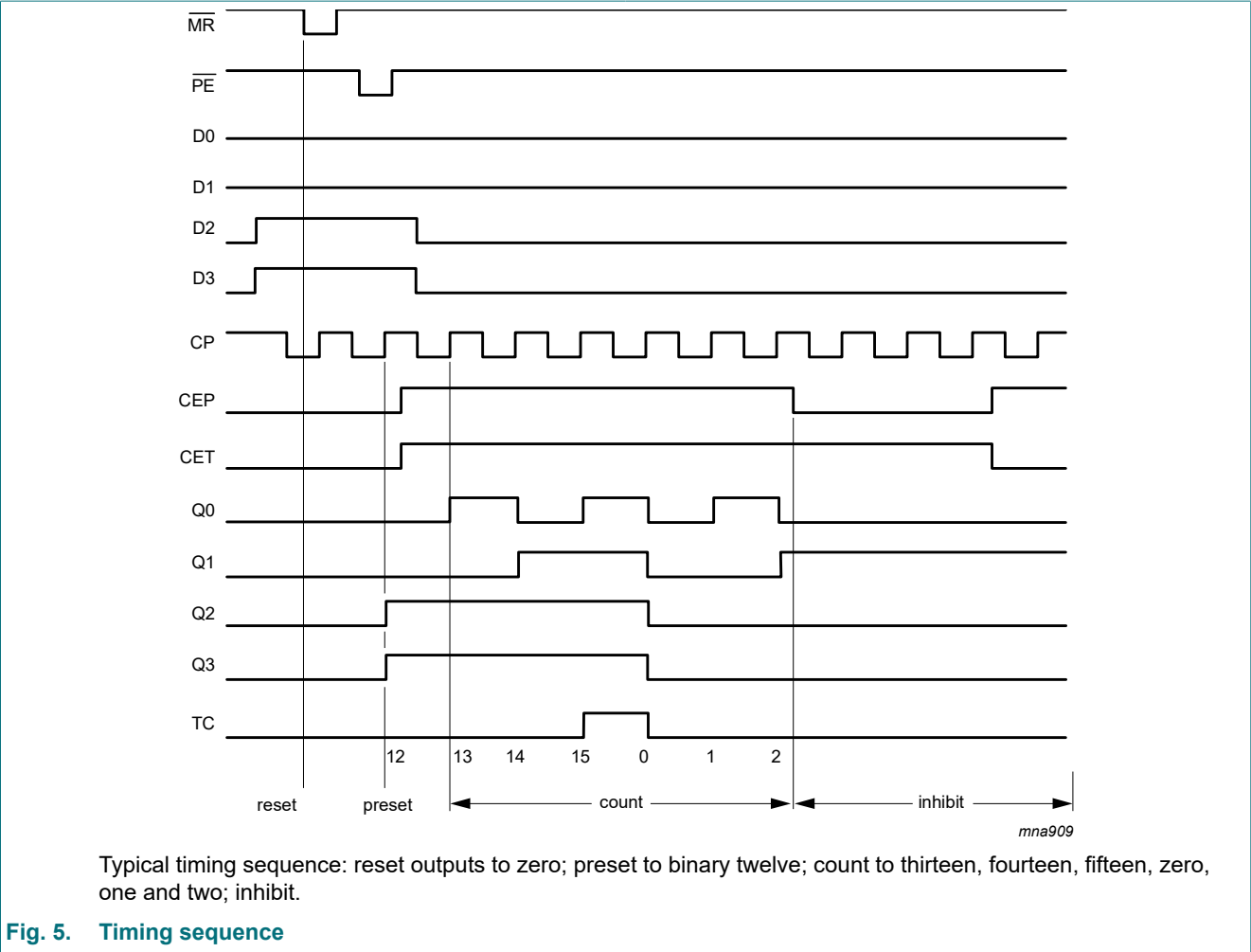
3. Ordering information

| Type number                | Package           |          |                                                                                                                                |                          |
|----------------------------|-------------------|----------|--------------------------------------------------------------------------------------------------------------------------------|--------------------------|
|                            | Temperature range | Name     | Description                                                                                                                    | Version                  |
| <a href="#">74LVC161D</a>  | -40 °C to +125 °C | SO16     | plastic small outline package; 16 leads; body width 3.9 mm                                                                     | <a href="#">SOT109-1</a> |
| <a href="#">74LVC161PW</a> | -40 °C to +125 °C | TSSOP16  | plastic thin shrink small outline package; 16 leads; body width 4.4 mm                                                         | <a href="#">SOT403-1</a> |
| <a href="#">74LVC161BQ</a> | -40 °C to +125 °C | DHVQFN16 | plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 × 3.5 × 0.85 mm | <a href="#">SOT763-1</a> |

4. Functional diagram



Presettable synchronous 4-bit binary counter; asynchronous reset



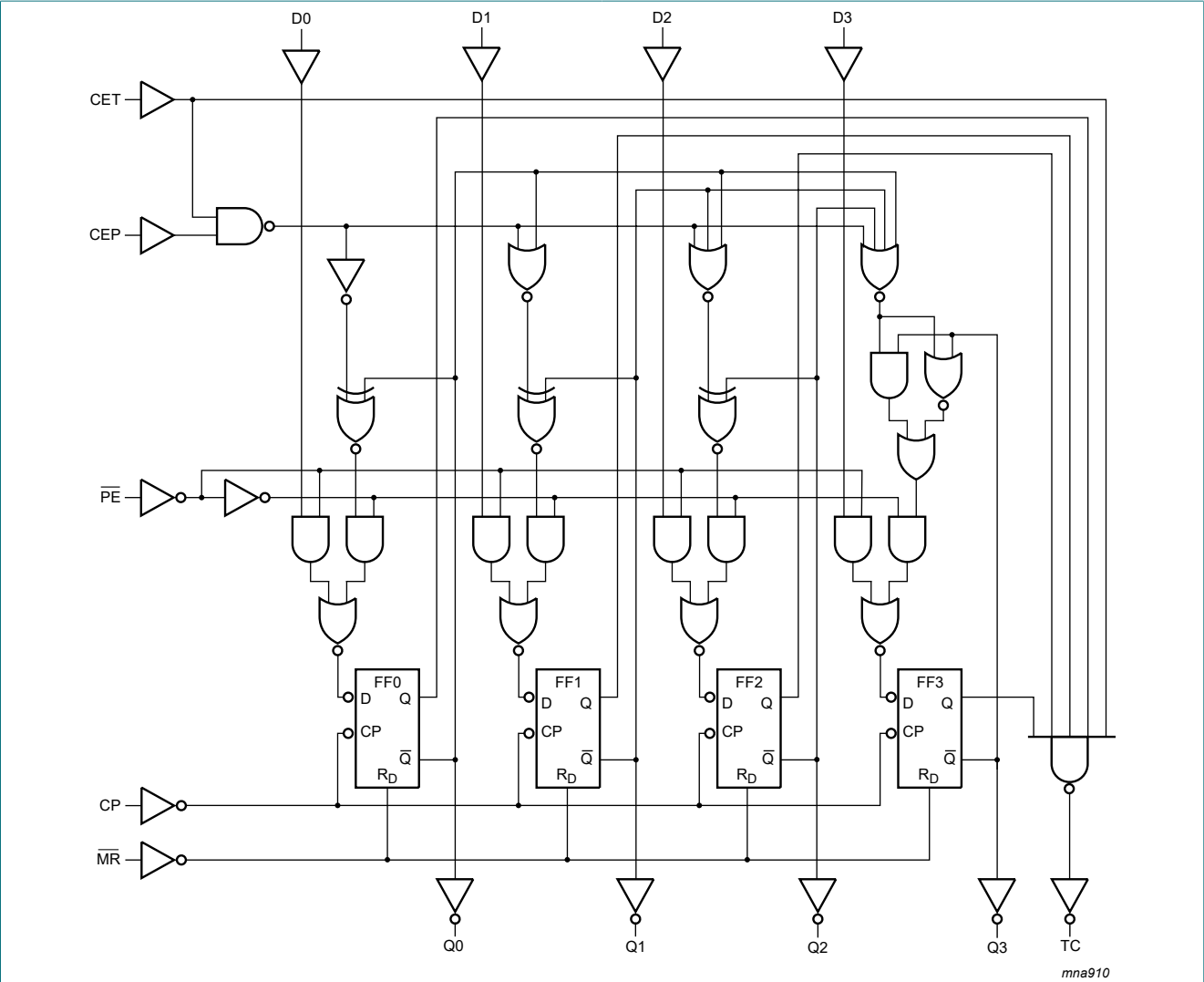
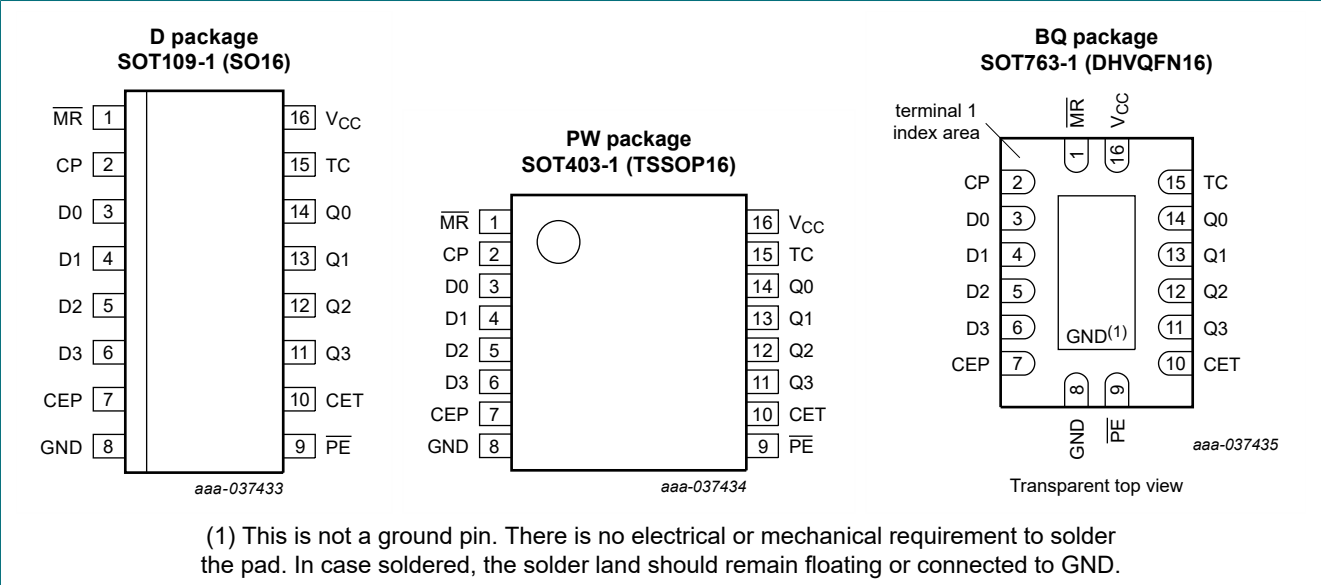


Fig. 6. Logic diagram

5. Pinning information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

| Symbol          | Pin            | Description                               |
|-----------------|----------------|-------------------------------------------|
| MR              | 1              | synchronous master reset (active LOW)     |
| CP              | 2              | clock input (LOW-to-HIGH, edge-triggered) |
| D0, D1, D2, D3  | 3, 4, 5, 6     | data input                                |
| CEP             | 7              | count enable input                        |
| GND             | 8              | ground (0 V)                              |
| PE              | 9              | parallel enable input (active LOW)        |
| CET             | 10             | count enable carry input                  |
| Q0, Q1, Q2, Q3  | 14, 13, 12, 11 | flip-flop output                          |
| TC              | 15             | terminal count output                     |
| V <sub>CC</sub> | 16             | supply voltage                            |

6. Functional description

Table 3. Function table

\* = the TC output is HIGH when CET is HIGH and the counter is at terminal count (HHHH);  
H = HIGH voltage level; h = HIGH voltage level one set-up time prior to the LOW-to-HIGH clock transition;  
L = LOW voltage level; l = LOW voltage level one set-up time prior to the LOW-to-HIGH clock transition;  
q = lower case letters indicate the state of the referenced output one set-up time prior to the LOW-to-HIGH clock transition;  
X = don't care; ↑ = LOW-to-HIGH clock transition

| Operating modes   | Input |    |     |     |    |    | Output         |    |
|-------------------|-------|----|-----|-----|----|----|----------------|----|
|                   | MR    | CP | CEP | CET | PE | Dn | Qn             | TC |
| Reset (clear)     | L     | X  | X   | X   | X  | X  | L              | L  |
| Parallel load     | H     | ↑  | X   | X   | l  | l  | L              | L  |
|                   | H     | ↑  | X   | X   | l  | h  | H              | *  |
| Count             | H     | ↑  | h   | h   | h  | X  | count          | *  |
| Hold (do nothing) | H     | X  | l   | X   | h  | X  | q <sub>n</sub> | *  |
|                   | H     | X  | X   | l   | h  | X  | q <sub>n</sub> | L  |

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 | +6.5                  | V    |
| I <sub>IK</sub>  | input clamping current  | V <sub>I</sub> < 0                                     | -50  | -                     | mA   |
| V <sub>I</sub>   | input voltage           | [1]                                                    | -0.5 | +6.5                  | V    |
| I <sub>OK</sub>  | output clamping current | V <sub>O</sub> > V <sub>CC</sub> or V <sub>O</sub> < 0 | -    | ±50                   | mA   |
| V <sub>O</sub>   | output voltage          | [2]                                                    | -0.5 | V <sub>CC</sub> + 0.5 | V    |
| I <sub>O</sub>   | output current          | V <sub>O</sub> = 0 V to V <sub>CC</sub>                | -    | ±50                   | mA   |
| I <sub>CC</sub>  | supply current          |                                                        | -    | 100                   | mA   |
| I <sub>GND</sub> | ground current          |                                                        | -100 | -                     | mA   |
| T <sub>stg</sub> | storage temperature     |                                                        | -65  | +150                  | °C   |
| P <sub>tot</sub> | total power dissipation | T <sub>amb</sub> = -40 °C to +125 °C [3]               | -    | 500                   | mW   |

- [1] The minimum input voltage ratings may be exceeded if the input current ratings are observed.  
[2] The output voltage ratings may be exceeded if the output current ratings are observed.  
[3] 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.  
For SOT763-1 (DHVQFN16) package: P<sub>tot</sub> derates linearly with 11.2 mW/K above 106 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions

| Symbol           | Parameter                           | Conditions                        | Min  | Typ | Max             | Unit |
|------------------|-------------------------------------|-----------------------------------|------|-----|-----------------|------|
| V <sub>CC</sub>  | supply voltage                      |                                   | 1.65 | -   | 3.6             | V    |
|                  |                                     | functional                        | 1.2  | -   | -               | V    |
| V <sub>I</sub>   | input voltage                       |                                   | 0    | -   | 5.5             | V    |
| V <sub>O</sub>   | output voltage                      |                                   | 0    | -   | V <sub>CC</sub> | V    |
| T <sub>amb</sub> | ambient temperature                 | in free air                       | -40  | -   | +125            | °C   |
| Δt/ΔV            | input transition rise and fall rate | V <sub>CC</sub> = 1.65 V to 2.7 V | 0    | -   | 20              | ns/V |
|                  |                                     | V <sub>CC</sub> = 2.7 V to 3.6 V  | 0    | -   | 10              | ns/V |

9. Static characteristics

Table 6. Static characteristics

At recommended operating conditions. Voltages are referenced to GND (ground = 0 V).

| Symbol          | Parameter                 | Conditions                                                  | -40 °C to +85 °C       |         |                        | -40 °C to +125 °C      |                        | Unit |
|-----------------|---------------------------|-------------------------------------------------------------|------------------------|---------|------------------------|------------------------|------------------------|------|
|                 |                           |                                                             | Min                    | Typ [1] | Max                    | Min                    | Max                    |      |
| V <sub>IH</sub> | HIGH-level input voltage  | V <sub>CC</sub> = 1.2 V                                     | 1.08                   | -       | -                      | 1.08                   | -                      | V    |
|                 |                           | V <sub>CC</sub> = 1.65 V to 1.95 V                          | 0.65 × V <sub>CC</sub> | -       | -                      | 0.65 × V <sub>CC</sub> | -                      | V    |
|                 |                           | V <sub>CC</sub> = 2.3 V to 2.7 V                            | 1.7                    | -       | -                      | 1.7                    | -                      | V    |
|                 |                           | V <sub>CC</sub> = 2.7 V to 3.6 V                            | 2.0                    | -       | -                      | 2.0                    | -                      | V    |
| V <sub>IL</sub> | LOW-level input voltage   | V <sub>CC</sub> = 1.2 V                                     | -                      | -       | 0.12                   | -                      | 0.12                   | V    |
|                 |                           | V <sub>CC</sub> = 1.65 V to 1.95 V                          | -                      | -       | 0.35 × V <sub>CC</sub> | -                      | 0.35 × V <sub>CC</sub> | V    |
|                 |                           | V <sub>CC</sub> = 2.3 V to 2.7 V                            | -                      | -       | 0.7                    | -                      | 0.7                    | V    |
|                 |                           | V <sub>CC</sub> = 2.7 V to 3.6 V                            | -                      | -       | 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>         |                        |         |                        |                        |                        |      |
|                 |                           | I <sub>O</sub> = -100 μA; V <sub>CC</sub> = 1.65 V to 3.6 V | V <sub>CC</sub> - 0.2  | -       | -                      | V <sub>CC</sub> - 0.3  | -                      | V    |
|                 |                           | I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 1.65 V            | 1.2                    | -       | -                      | 1.05                   | -                      | V    |
|                 |                           | I <sub>O</sub> = -8 mA; V <sub>CC</sub> = 2.3 V             | 1.8                    | -       | -                      | 1.65                   | -                      | V    |
|                 |                           | I <sub>O</sub> = -12 mA; V <sub>CC</sub> = 2.7 V            | 2.2                    | -       | -                      | 2.05                   | -                      | V    |
|                 |                           | I <sub>O</sub> = -18 mA; V <sub>CC</sub> = 3.0 V            | 2.4                    | -       | -                      | 2.25                   | -                      | V    |
|                 |                           | I <sub>O</sub> = -24 mA; V <sub>CC</sub> = 3.0 V            | 2.2                    | -       | -                      | 2.0                    | -                      | 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> = 100 μA; V <sub>CC</sub> = 1.65 V to 3.6 V  | -                      | -       | 0.2                    | -                      | 0.3                    | V    |
|                 |                           | I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V             | -                      | -       | 0.45                   | -                      | 0.65                   | V    |
|                 |                           | I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V              | -                      | -       | 0.6                    | -                      | 0.8                    | V    |
|                 |                           | I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V             | -                      | -       | 0.4                    | -                      | 0.6                    | V    |
|                 |                           | I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V             | -                      | -       | 0.55                   | -                      | 0.8                    | V    |

Presetable synchronous 4-bit binary counter; asynchronous reset

| Symbol           | Parameter                 | Conditions                                                                                                            | -40 °C to +85 °C |         |     | -40 °C to +125 °C |      | Unit |
|------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------|------------------|---------|-----|-------------------|------|------|
|                  |                           |                                                                                                                       | Min              | Typ [1] | Max | Min               | Max  |      |
| I <sub>I</sub>   | input leakage current     | V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = 5.5 V or GND                                                                | -                | ±0.1    | ±5  | -                 | ±20  | µA   |
| I <sub>CC</sub>  | supply current            | V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A                                | -                | 0.1     | 10  | -                 | 40   | µA   |
| ΔI <sub>CC</sub> | additional supply current | per input pin;<br>V <sub>CC</sub> = 2.7 V to 3.6 V;<br>V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A | -                | 5       | 500 | -                 | 5000 | µA   |
| C <sub>I</sub>   | input capacitance         | V <sub>CC</sub> = 0 V to 3.6 V;<br>V <sub>I</sub> = GND to V <sub>CC</sub>                                            | -                | 5.0     | -   | -                 | -    | pF   |

[1] All typical values are measured at V<sub>CC</sub> = 3.3 V (unless stated otherwise) and T<sub>amb</sub> = 25 °C.

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). For test circuit see Fig. 12.

| Symbol          | Parameter         | Conditions                            | -40 °C to +85 °C |         |      | -40 °C to +125 °C |      | Unit |
|-----------------|-------------------|---------------------------------------|------------------|---------|------|-------------------|------|------|
|                 |                   |                                       | Min              | Typ [1] | Max  | Min               | Max  |      |
| t <sub>pd</sub> | propagation delay | CP to Q <sub>n</sub> ; see Fig. 7 [2] |                  |         |      |                   |      |      |
|                 |                   | V <sub>CC</sub> = 1.2 V               | -                | 17      | -    | -                 | -    | ns   |
|                 |                   | V <sub>CC</sub> = 1.65 V to 1.95 V    | 1.5              | 7.0     | 14.5 | 1.5               | 16.7 | ns   |
|                 |                   | V <sub>CC</sub> = 2.3 V to 2.7 V      | 2.5              | 4.0     | 8.1  | 2.5               | 9.4  | ns   |
|                 |                   | V <sub>CC</sub> = 2.7 V               | 1.5              | 3.8     | 7.2  | 1.5               | 9.0  | ns   |
|                 |                   | V <sub>CC</sub> = 3.0 V to 3.6 V      | 1.5              | 3.6     | 7.3  | 1.5               | 9.5  | ns   |
|                 |                   | CP to TC; see Fig. 7 [2]              |                  |         |      |                   |      |      |
|                 |                   | V <sub>CC</sub> = 1.2 V               | -                | 20      | -    | -                 | -    | ns   |
|                 |                   | V <sub>CC</sub> = 1.65 V to 1.95 V    | 1.8              | 8.1     | 15.5 | 1.8               | 17.9 | ns   |
|                 |                   | V <sub>CC</sub> = 2.3 V to 2.7 V      | 2.8              | 4.6     | 8.7  | 2.8               | 10.1 | ns   |
|                 |                   | V <sub>CC</sub> = 2.7 V               | 1.5              | 4.3     | 7.8  | 1.5               | 10.0 | ns   |
|                 |                   | V <sub>CC</sub> = 3.0 V to 3.6 V      | 1.5              | 4.2     | 7.8  | 1.5               | 10.0 | ns   |
|                 |                   | CET to TC; see Fig. 8 [2]             |                  |         |      |                   |      |      |
|                 |                   | V <sub>CC</sub> = 1.2 V               | -                | 16      | -    | -                 | -    | ns   |
|                 |                   | V <sub>CC</sub> = 1.65 V to 1.95 V    | 1.5              | 5.9     | 11.9 | 1.5               | 13.7 | ns   |
|                 |                   | V <sub>CC</sub> = 2.3 V to 2.7 V      | 1.9              | 3.4     | 6.7  | 1.9               | 7.7  | ns   |
|                 |                   | V <sub>CC</sub> = 2.7 V               | 1.5              | 3.6     | 6.5  | 1.5               | 8.5  | ns   |
|                 |                   | V <sub>CC</sub> = 3.0 V to 3.6 V      | 1.5              | 3.1     | 6.0  | 1.5               | 7.5  | ns   |

## Presettable synchronous 4-bit binary counter; asynchronous reset

| Symbol           | Parameter                     | Conditions                         | -40 °C to +85 °C |         |      | -40 °C to +125 °C |      | Unit |
|------------------|-------------------------------|------------------------------------|------------------|---------|------|-------------------|------|------|
|                  |                               |                                    | Min              | Typ [1] | Max  | Min               | Max  |      |
| t <sub>PHL</sub> | HIGH to LOW propagation delay | MR to Qn; see Fig. 9               |                  |         |      |                   |      |      |
|                  |                               | V <sub>CC</sub> = 1.2 V            | -                | 17      | -    | -                 | -    | ns   |
|                  |                               | V <sub>CC</sub> = 1.65 V to 1.95 V | 1.5              | 6.2     | 12.7 | 1.5               | 14.6 | ns   |
|                  |                               | V <sub>CC</sub> = 2.3 V to 2.7 V   | 1.9              | 3.6     | 7.1  | 1.9               | 8.3  | ns   |
|                  |                               | V <sub>CC</sub> = 2.7 V            | 1.5              | 3.9     | 7.1  | 1.5               | 9.0  | ns   |
|                  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V   | 1.5              | 3.2     | 6.4  | 1.5               | 8.0  | ns   |
|                  |                               | MR to TC; see Fig. 9               |                  |         |      |                   |      |      |
|                  |                               | V <sub>CC</sub> = 1.2 V            | -                | 18      | -    | -                 | -    | ns   |
|                  |                               | V <sub>CC</sub> = 1.65 V to 1.95 V | 1.7              | 8.3     | 15.9 | 1.7               | 18.4 | ns   |
|                  |                               | V <sub>CC</sub> = 2.3 V to 2.7 V   | 2.7              | 4.8     | 8.9  | 2.7               | 10.3 | ns   |
|                  |                               | V <sub>CC</sub> = 2.7 V            | 1.5              | 4.9     | 8.6  | 1.5               | 11.0 | ns   |
|                  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V   | 1.5              | 4.3     | 8.0  | 1.5               | 10.0 | ns   |
| t <sub>W</sub>   | pulse width                   | clock HIGH or LOW; see Fig. 7      |                  |         |      |                   |      |      |
|                  |                               | V <sub>CC</sub> = 1.65 V to 1.95 V | 6.0              | -       | -    | 6.0               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 2.3 V to 2.7 V   | 5.0              | -       | -    | 5.0               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 2.7 V            | 5.0              | -       | -    | 5.0               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V   | 4.0              | 1.2     | -    | 4.0               | -    | ns   |
|                  |                               | MR LOW; see Fig. 9                 |                  |         |      |                   |      |      |
|                  |                               | V <sub>CC</sub> = 1.65 V to 1.95 V | 5.0              | -       | -    | 5.0               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 2.3 V to 2.7 V   | 4.0              | -       | -    | 4.0               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 2.7 V            | 4.0              | -       | -    | 4.0               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V   | 3.0              | 1.6     | -    | 3.0               | -    | ns   |
| t <sub>rec</sub> | recovery time                 | MR to CP; see Fig. 9               |                  |         |      |                   |      |      |
|                  |                               | V <sub>CC</sub> = 1.65 V to 1.95 V | 1.0              | -       | -    | 1.0               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 2.3 V to 2.7 V   | 1.0              | -       | -    | 1.0               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 2.7 V            | 0.0              | -       | -    | 0.0               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V   | 0.5              | 0.0     | -    | 0.5               | -    | ns   |
| t <sub>su</sub>  | set-up time                   | Dn to CP; see Fig. 10              |                  |         |      |                   |      |      |
|                  |                               | V <sub>CC</sub> = 1.65 V to 1.95 V | 5.0              | -       | -    | 5.0               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 2.3 V to 2.7 V   | 4.0              | -       | -    | 4.0               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 2.7 V            | 3.0              | -       | -    | 3.0               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V   | 2.5              | 1.0     | -    | 2.5               | -    | ns   |
|                  |                               | PE to CP; see Fig. 10              |                  |         |      |                   |      |      |
|                  |                               | V <sub>CC</sub> = 1.65 V to 1.95 V | 4.5              | -       | -    | 4.5               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 2.3 V to 2.7 V   | 4.0              | -       | -    | 4.0               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 2.7 V            | 3.5              | -       | -    | 3.5               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V   | 3.0              | 1.2     | -    | 3.0               | -    | ns   |
|                  |                               | CET, CET to CP; see Fig. 11        |                  |         |      |                   |      |      |
|                  |                               | V <sub>CC</sub> = 1.65 V to 1.95 V | 8.0              | -       | -    | 8.0               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 2.3 V to 2.7 V   | 6.0              | -       | -    | 6.0               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 2.7 V            | 5.5              | -       | -    | 5.5               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V   | 5.0              | 2.1     | -    | 5.0               | -    | ns   |

## Presettable synchronous 4-bit binary counter; asynchronous reset

| Symbol      | Parameter                     | Conditions                                                                                       | -40 °C to +85 °C |         |     | -40 °C to +125 °C |     | Unit |
|-------------|-------------------------------|--------------------------------------------------------------------------------------------------|------------------|---------|-----|-------------------|-----|------|
|             |                               |                                                                                                  | Min              | Typ [1] | Max | Min               | Max |      |
| $t_h$       | hold time                     | Dn, $\overline{PE}$ , CEP, CET to CP;<br>see <a href="#">Fig. 10</a> and <a href="#">Fig. 11</a> |                  |         |     |                   |     |      |
|             |                               | $V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$                                                     | 3.0              | -       | -   | 3.0               | -   | ns   |
|             |                               | $V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$                                                       | 2.5              | -       | -   | 2.5               | -   | ns   |
|             |                               | $V_{CC} = 2.7 \text{ V}$                                                                         | 0.0              | -       | -   | 0.0               | -   | ns   |
|             |                               | $V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$                                                       | 0.5              | 0.0     | -   | 0.5               | -   | ns   |
| $f_{\max}$  | maximum frequency             | see <a href="#">Fig. 7</a>                                                                       |                  |         |     |                   |     |      |
|             |                               | $V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$                                                     | 100              | -       | -   | 80                | -   | MHZ  |
|             |                               | $V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$                                                       | 125              | -       | -   | 100               | -   | MHZ  |
|             |                               | $V_{CC} = 2.7 \text{ V}$                                                                         | 150              | -       | -   | 120               | -   | MHz  |
|             |                               | $V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$                                                       | 150              | 200     | -   | 120               | -   | MHz  |
| $t_{sk(o)}$ | output skew time              | $V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$ [3]                                                   | -                | -       | 1.0 | -                 | 1.5 | ns   |
| $C_{PD}$    | power dissipation capacitance | per input; $V_I = \text{GND to } V_{CC}$ [4]                                                     |                  |         |     |                   |     |      |
|             |                               | $V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$                                                     | -                | 11.1    | -   | -                 | -   | pF   |
|             |                               | $V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$                                                       | -                | 14.7    | -   | -                 | -   | pF   |
|             |                               | $V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$                                                       | -                | 17.9    | -   | -                 | -   | pF   |

[1] Typical values are measured at  $T_{\text{amb}} = 25 \text{ °C}$  and  $V_{CC} = 1.2 \text{ V}, 1.8 \text{ V}, 2.5 \text{ V}, 2.7 \text{ V}$  and  $3.3 \text{ V}$  respectively.

[2]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .

[3] Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.

[4]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ).

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

$f_i$  = input frequency in MHz;  $f_o$  = output frequency in MHz

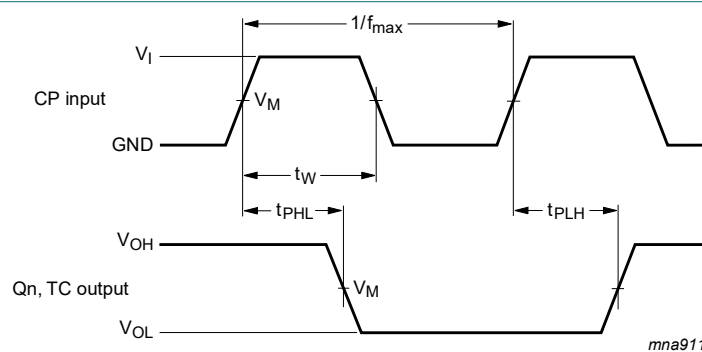
$C_L$  = output load capacitance in pF

$V_{CC}$  = supply voltage in V

$N$  = number of inputs switching

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

## 10.1. Waveforms and test circuit

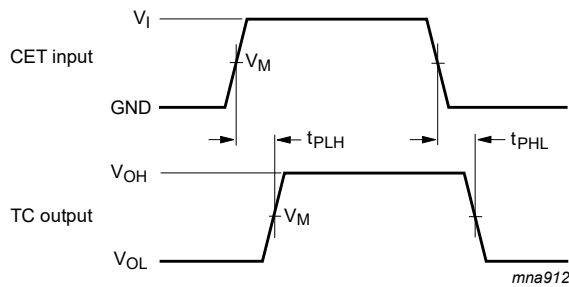


Measurement points are given in [Table 8](#).

$V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

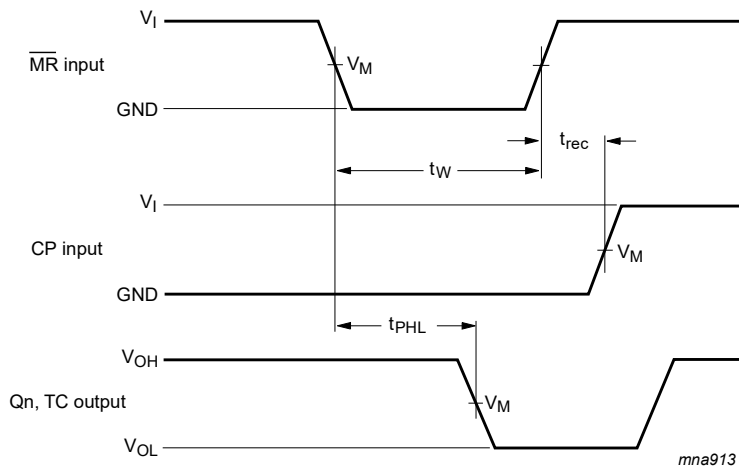
**Fig. 7.** Clock (CP) to outputs (Qn, TC) propagation delays, the clock pulse width, and maximum frequency

Presettable synchronous 4-bit binary counter; asynchronous reset



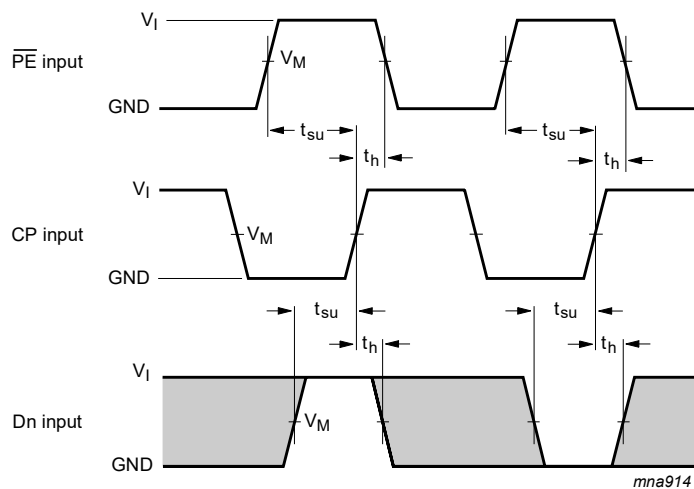
Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

Fig. 8. Input (CET) to output (TC) propagation delays



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

Fig. 9. Master reset (MR) pulse width, the master reset to output ( $Q_n$ , TC) propagation delays, and the master reset to clock (CP) removal times



Measurement points are given in [Table 8](#).  
The shaded areas indicate when the input is permitted to change for predictable output performance.

Fig. 10. Set-up and hold times for the input ( $D_n$ ) and parallel enable input ( $\overline{PE}$ )

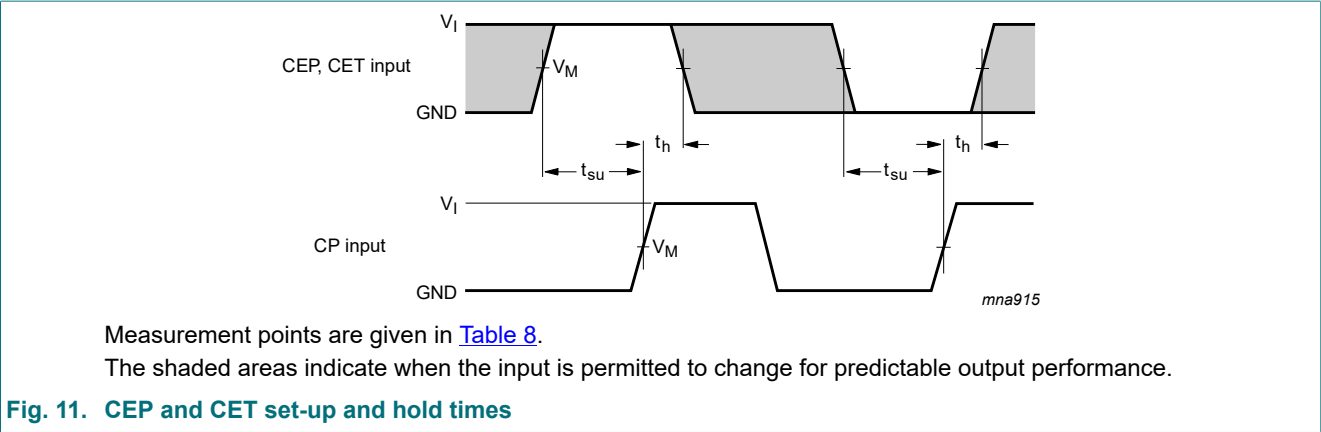
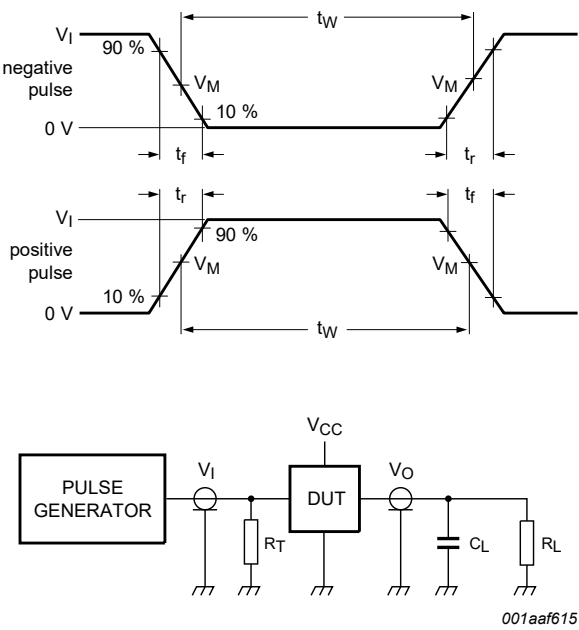


Table 8. Measurement points

| Supply voltage   | Input           |                       | Output                |
|------------------|-----------------|-----------------------|-----------------------|
| V <sub>CC</sub>  | V <sub>I</sub>  | V <sub>M</sub>        | V <sub>M</sub>        |
| 1.2 V            | V <sub>CC</sub> | 0.5 × V <sub>CC</sub> | 0.5 × V <sub>CC</sub> |
| 1.65 V to 1.95 V | V <sub>CC</sub> | 0.5 × V <sub>CC</sub> | 0.5 × V <sub>CC</sub> |
| 2.3 V to 2.7 V   | V <sub>CC</sub> | 0.5 × V <sub>CC</sub> | 0.5 × V <sub>CC</sub> |
| 2.7 V            | 2.7 V           | 1.5 V                 | 1.5 V                 |
| 3.0 V to 3.6 V   | 2.7 V           | 1.5 V                 | 1.5 V                 |



Test data is given in [Table 9](#). Definitions for test circuit:  
 $R_L$  = Load resistance;  
 $C_L$  = Load capacitance including jig and probe capacitance;  
 $R_T$  = Termination resistance should be equal to output impedance  $Z_o$  of the pulse generator.

Fig. 12. Test circuit for measuring switching times

Table 9. Test data

| Supply voltage   | Input    |                       | Load  |              |
|------------------|----------|-----------------------|-------|--------------|
|                  | $V_I$    | $t_r, t_f$            | $C_L$ | $R_L$        |
| 1.2 V            | $V_{CC}$ | $\leq 2 \text{ ns}$   | 30 pF | 1 k $\Omega$ |
| 1.65 V to 1.95 V | $V_{CC}$ | $\leq 2 \text{ ns}$   | 30 pF | 1 k $\Omega$ |
| 2.3 V to 2.7 V   | $V_{CC}$ | $\leq 2 \text{ ns}$   | 30 pF | 500 $\Omega$ |
| 2.7 V            | 2.7 V    | $\leq 2.5 \text{ ns}$ | 50 pF | 500 $\Omega$ |
| 3.0 V to 3.6 V   | 2.7 V    | $\leq 2.5 \text{ ns}$ | 50 pF | 500 $\Omega$ |

11. Package outline

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

SOT109-1

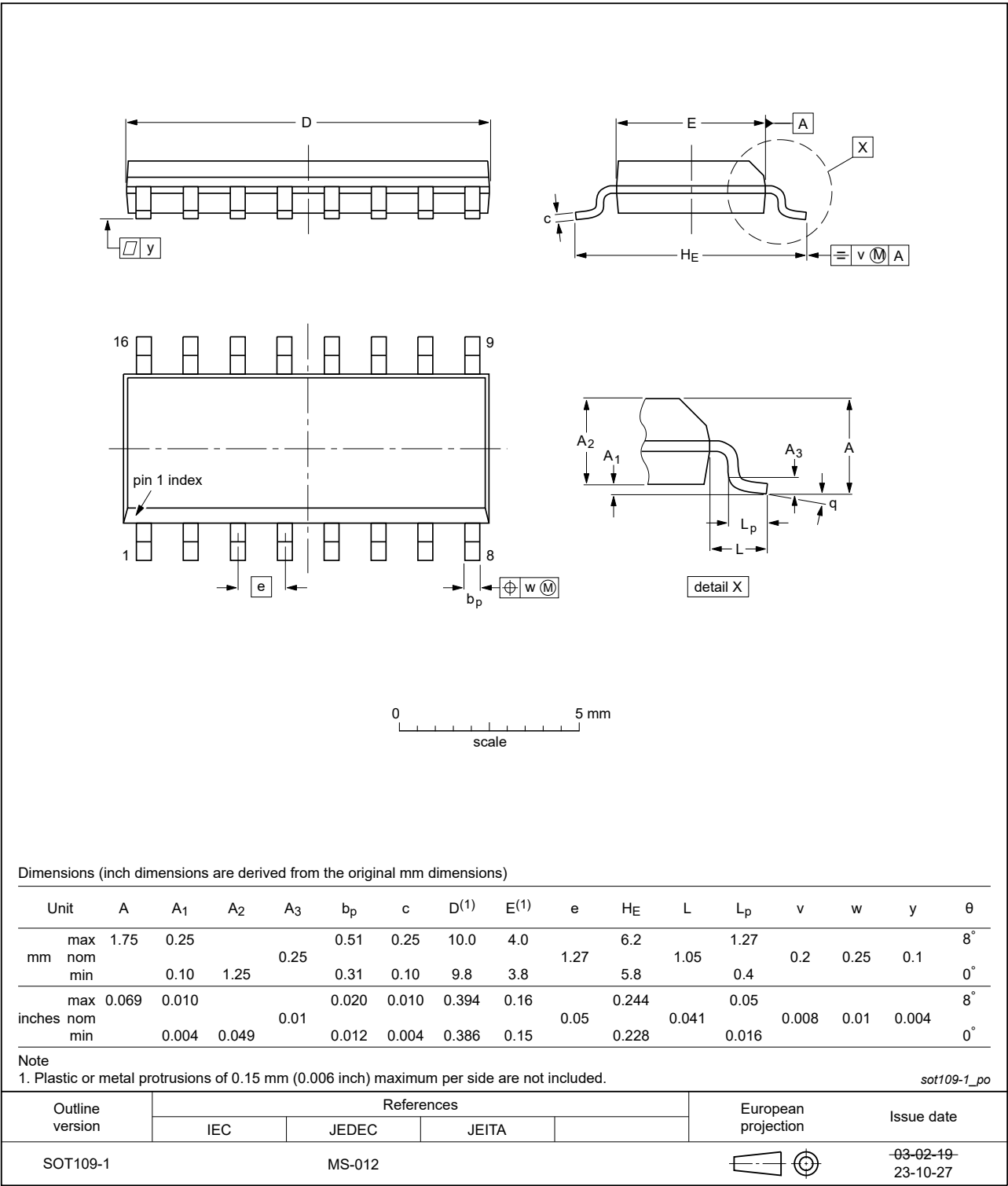


Fig. 13. Package outline SOT109-1 (SO16)

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

SOT403-1

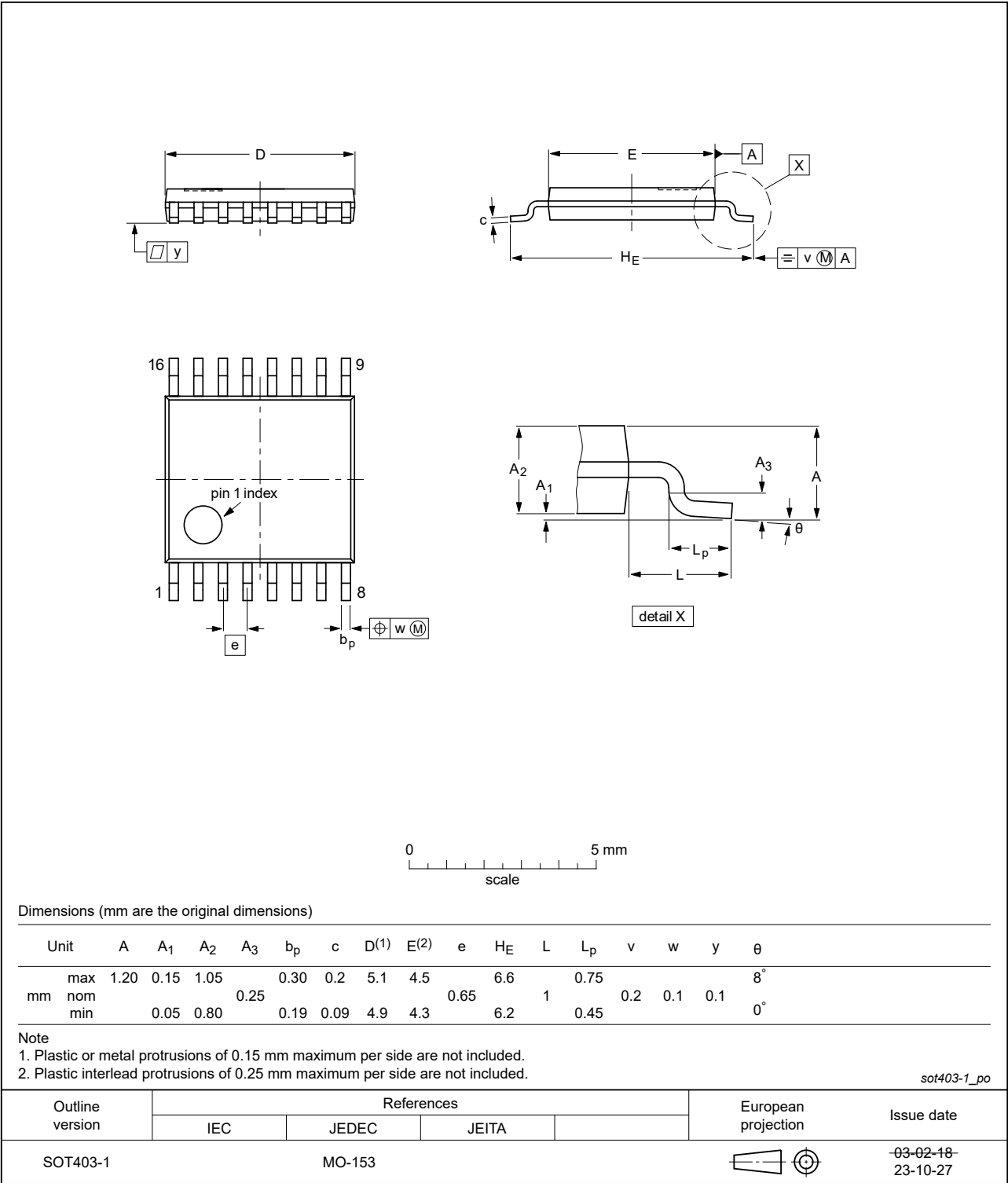


Fig. 14. Package outline SOT403-1 (TSSOP16)

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

SOT763-1



Fig. 15. Package outline SOT763-1 (DHVQFN16)

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                        |
| TTL     | Transistor-Transistor Logic             |

13. Revision history

Table 11. Revision history

| Document ID    | Release date                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Data sheet status     | Change notice | Supersedes   |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|--------------|
| 74LVC161 v.9   | 20240212                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Product data sheet    | -             | 74LVC161 v.8 |
| Modifications: | <ul style="list-style-type: none"><li><a href="#">Fig. 13</a>, <a href="#">Fig. 14</a>: Aligned SO and TSSOP package outline drawings to JEDEC MS-012 and MO-153.</li></ul>                                                                                                                                                                                                                                                                                                       |                       |               |              |
| 74LVC161 v.8   | 20230823                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Product data sheet    | -             | 74LVC161 v.7 |
| Modifications: | <ul style="list-style-type: none"><li><a href="#">Section 2</a>: ESD specification updated according to the latest JEDEC standard.</li></ul>                                                                                                                                                                                                                                                                                                                                      |                       |               |              |
| 74LVC161 v.7   | 20210922                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Product data sheet    | -             | 74LVC161 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><a href="#">Section 1</a> and <a href="#">Section 2</a> updated.</li><li>Type number 74LVC161DB (SOT338-1/SSOP16) removed.</li><li><a href="#">Section 7</a>: Derating values for P<sub>tot</sub> total power dissipation updated.</li></ul> |                       |               |              |
| 74LVC161 v.6   | 20130930                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Product data sheet    | -             | 74LVC161 v.5 |
| Modifications: | <ul style="list-style-type: none"><li><a href="#">Fig. 6</a>: Logic diagram corrected (errata).</li></ul>                                                                                                                                                                                                                                                                                                                                                                         |                       |               |              |
| 74LVC161 v.5   | 20121123                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Product data sheet    | -             | 74LVC161 v.4 |
| 74LVC161 v.4   | 20121122                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Product data sheet    | -             | 74LVC161 v.3 |
| 74LVC161 v.3   | 20040330                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Product specification | -             | 74LVC161 v.2 |
| 74LVC161 v.2   | 19980520                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Product specification | -             | 74LVC161 v.1 |
| 74LVC161 v.1   | 19960823                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 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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Contents

1. General description..... 1

2. Features and benefits..... 1

3. Ordering information.....2

4. Functional diagram.....2

5. Pinning information.....5

5.1. Pinning.....5

5.2. Pin description.....5

6. Functional description..... 6

7. Limiting values..... 6

8. Recommended operating conditions.....7

9. Static characteristics.....7

10. Dynamic characteristics..... 8

10.1. Waveforms and test circuit..... 10

11. Package outline..... 14

12. Abbreviations..... 17

13. Revision history.....17

14. Legal information.....18

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