



# 74HC165; 74HCT165

## 8-bit parallel-in/serial out shift register

Rev. 8 — 9 May 2025

Product data sheet

### 1. General description

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The 74HC165; 74HCT165 are 8-bit serial or parallel-in/serial-out shift registers. The device features a serial data input (DS), eight parallel data inputs (D0 to D7) and two complementary serial outputs (Q7 and  $\overline{Q7}$ ). When the parallel load input ( $\overline{PL}$ ) is LOW the data from D0 to D7 is loaded into the shift register asynchronously. When  $\overline{PL}$  is HIGH data enters the register serially at DS. When the clock enable input ( $\overline{CE}$ ) is LOW data is shifted on the LOW-to-HIGH transitions of the CP input. A HIGH on  $\overline{CE}$  will disable the CP input. Inputs are overvoltage tolerant to 15 V. This enables the device to be used in HIGH-to-LOW level shifting applications.

### 2. Features and benefits

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- 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
- Asynchronous 8-bit parallel load
- Synchronous serial input
- Input levels:
  - For 74HC165: CMOS level
  - For 74HCT165: TTL level
- Complies with JEDEC standards:
  - JESD8C (2.7 V to 3.6 V)
  - JESD7A (2.0 V to 6.0 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
- Multiple package options
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

### 3. Applications

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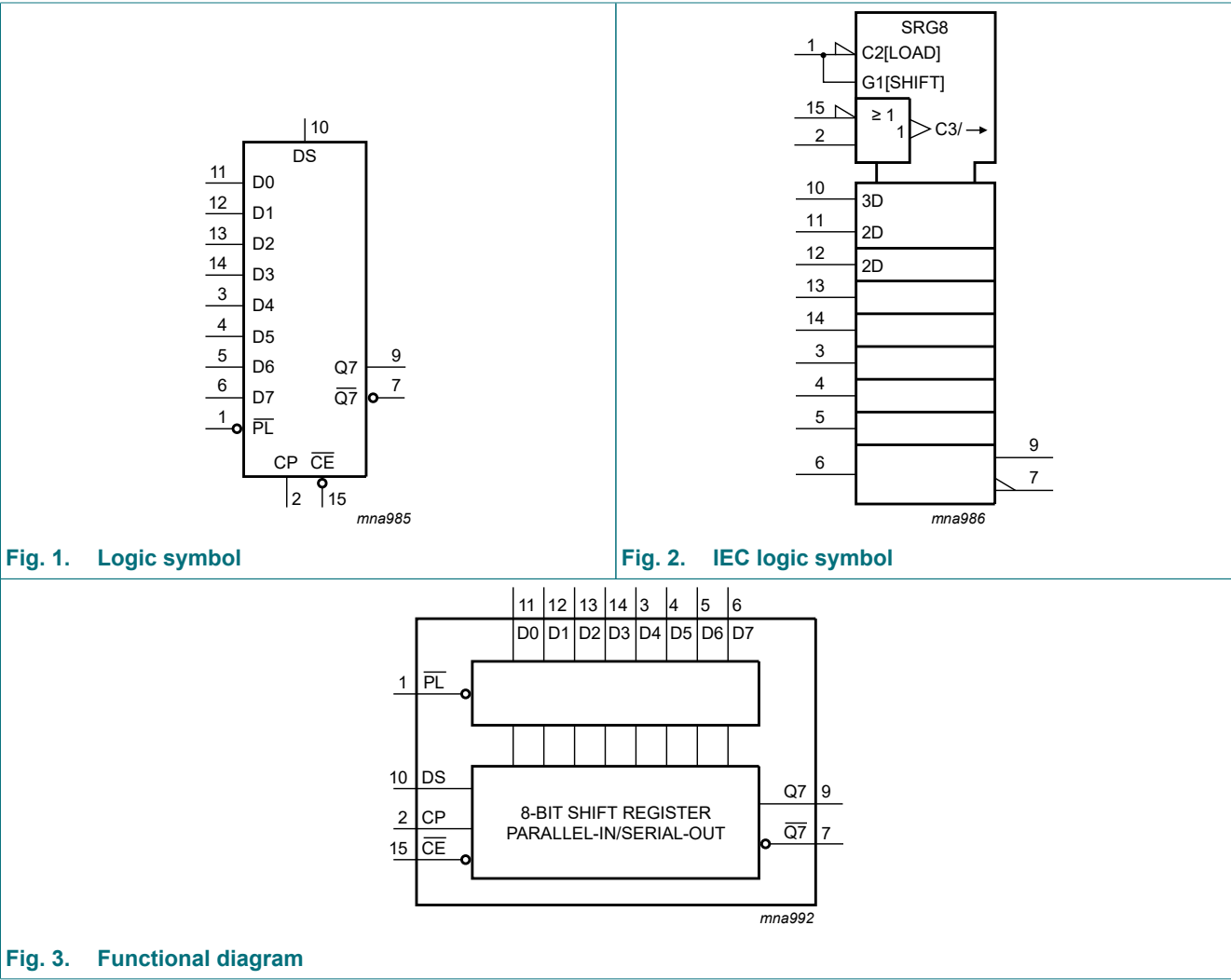
- Parallel-to-serial data conversion

4. Ordering information

Table 1. Ordering information

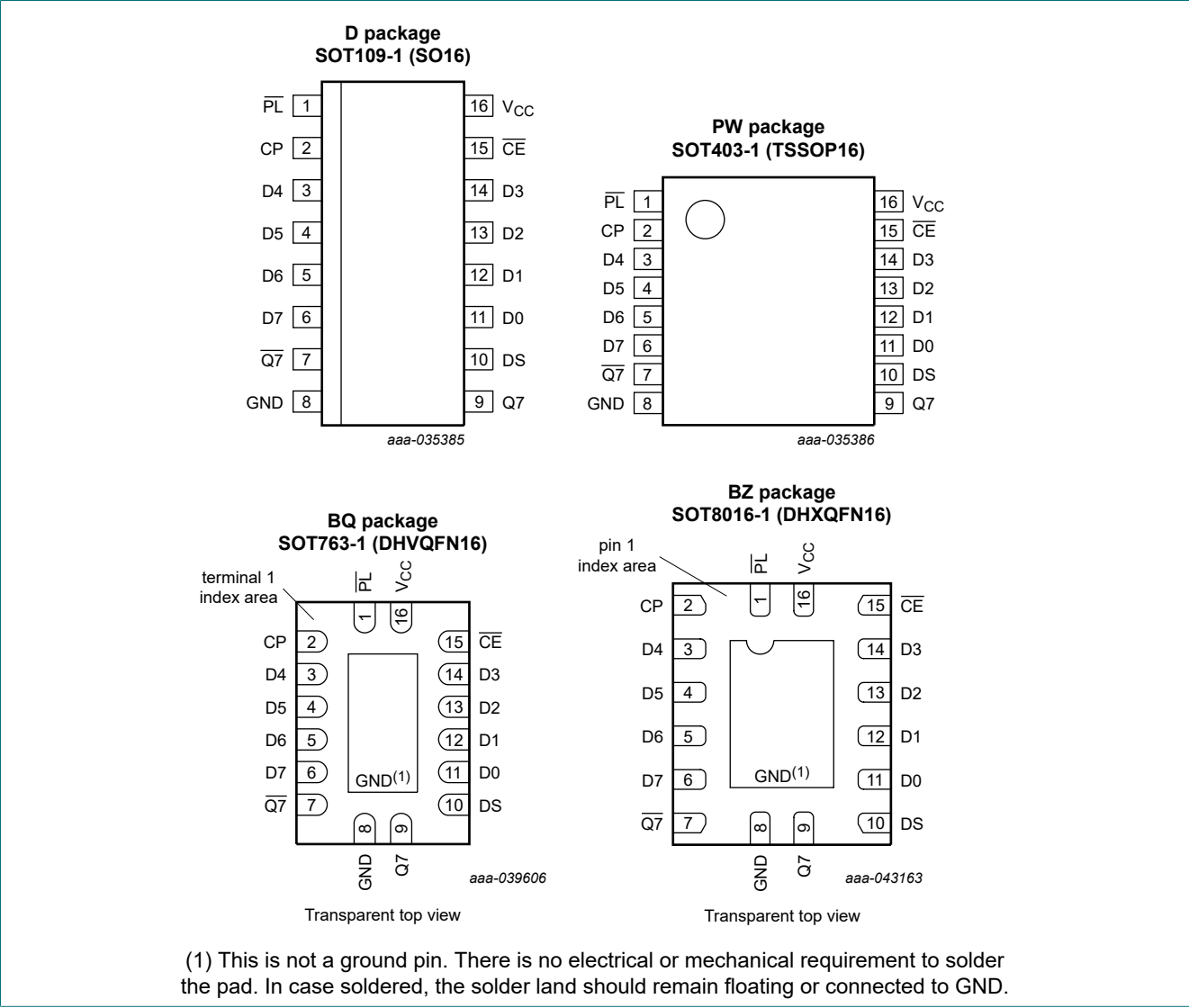
| Type number                                             | Package           |          |                                                                                                                                                                        |                           |
|---------------------------------------------------------|-------------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
|                                                         | Temperature range | Name     | Description                                                                                                                                                            | Version                   |
| <a href="#">74HC165D</a><br><a href="#">74HCT165D</a>   | -40 °C to +125 °C | SO16     | plastic small outline package; 16 leads;<br>body width 3.9 mm                                                                                                          | <a href="#">SOT109-1</a>  |
| <a href="#">74HC165PW</a><br><a href="#">74HCT165PW</a> | -40 °C to +125 °C | TSSOP16  | plastic thin shrink small outline package; 16 leads;<br>body width 4.4 mm                                                                                              | <a href="#">SOT403-1</a>  |
| <a href="#">74HC165BQ</a><br><a href="#">74HCT165BQ</a> | -40 °C to +125 °C | DHVQFN16 | plastic dual in-line compatible thermal enhanced<br>very thin quad flat package; no leads; 16 terminals;<br>body 2.5 × 3.5 × 0.85 mm                                   | <a href="#">SOT763-1</a>  |
| <a href="#">74HC165BZ</a><br><a href="#">74HCT165BZ</a> | -40 °C to +125 °C | DHXQFN16 | plastic, leadless dual in-line compatible thermal<br>enhanced extreme thin quad flat package;<br>no leads; 16 terminals; 0.4 mm pitch;<br>body 2 mm × 2.4 mm × 0.48 mm | <a href="#">SOT8016-1</a> |

5. Functional diagram



6. Pinning information

6.1. Pinning



6.2. Pin description

Table 2. Pin description

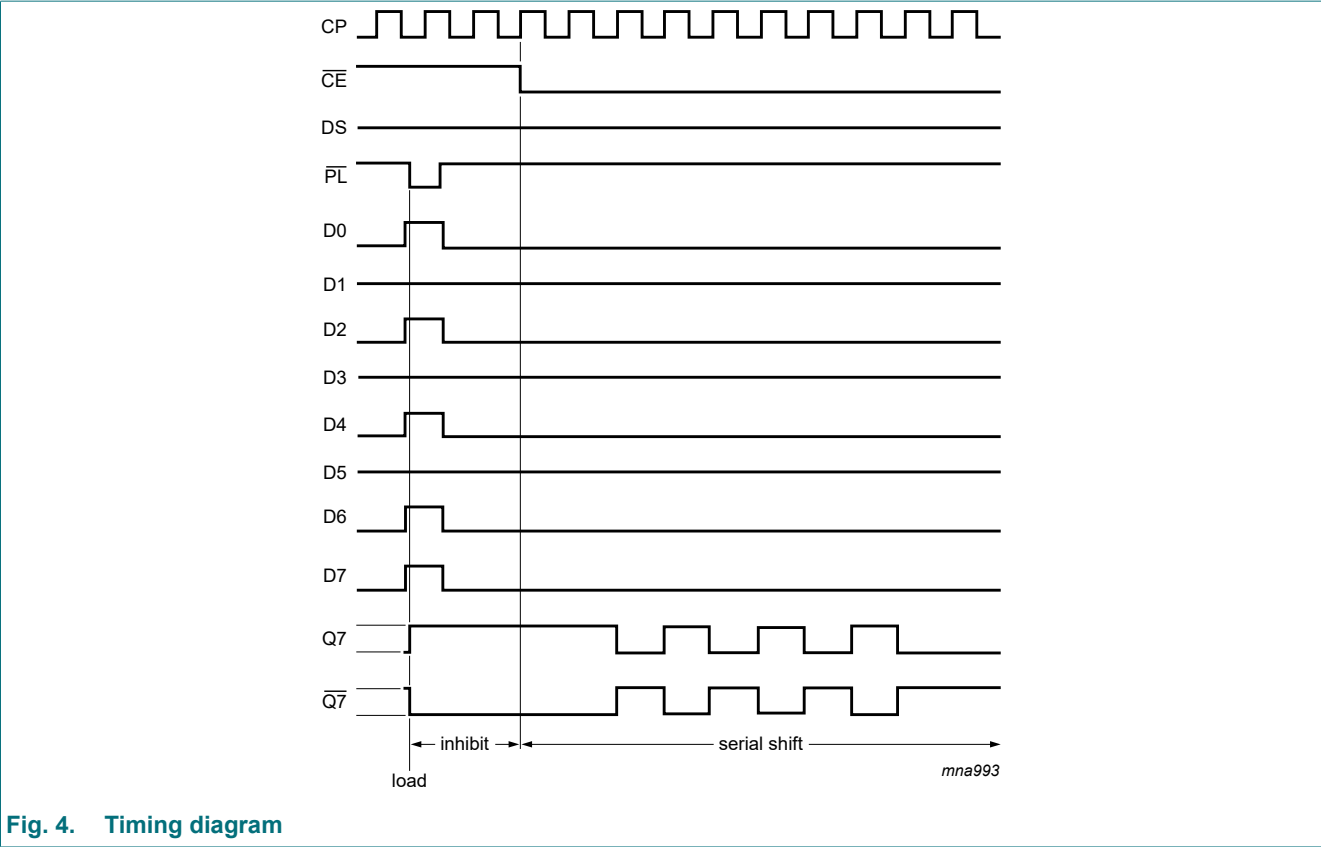
| Symbol          | Pin                        | Description                                   |
|-----------------|----------------------------|-----------------------------------------------|
| PL              | 1                          | asynchronous parallel load input (active LOW) |
| CP              | 2                          | clock input (LOW-to-HIGH edge-triggered)      |
| $\overline{Q7}$ | 7                          | complementary output from the last stage      |
| GND             | 8                          | ground (0 V)                                  |
| Q7              | 9                          | serial output from the last stage             |
| DS              | 10                         | serial data input                             |
| D0 to D7        | 11, 12, 13, 14, 3, 4, 5, 6 | parallel data inputs (also referred to as Dn) |
| $\overline{CE}$ | 15                         | clock enable input (active LOW)               |
| V <sub>CC</sub> | 16                         | positive supply voltage                       |

7. Functional description

Table 3. Function table

*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 = 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   | Inputs |                 |    |    |          | Qn registers |          | Outputs |                 |
|-------------------|--------|-----------------|----|----|----------|--------------|----------|---------|-----------------|
|                   | PL     | $\overline{CE}$ | CP | DS | D0 to D7 | Q0           | Q1 to Q6 | Q7      | $\overline{Q7}$ |
| parallel load     | L      | X               | X  | X  | L        | L            | L to L   | L       | H               |
|                   | L      | X               | X  | X  | H        | H            | H to H   | H       | L               |
| serial shift      | H      | L               | ↑  | l  | X        | L            | q0 to q5 | q6      | $\overline{q6}$ |
|                   | H      | L               | ↑  | h  | X        | H            | q0 to q5 | q6      | $\overline{q6}$ |
|                   | H      | ↑               | L  | l  | X        | L            | q0 to q5 | q6      | $\overline{q6}$ |
|                   | H      | ↑               | L  | h  | X        | H            | q0 to q5 | q6      | $\overline{q6}$ |
| hold "do nothing" | H      | H               | X  | X  | X        | q0           | q1 to q6 | q7      | $\overline{q7}$ |
|                   | H      | X               | H  | X  | X        | q0           | q1 to q6 | q7      | $\overline{q7}$ |



8. Limiting values

Table 4. Limiting values

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

| Symbol    | Parameter               | Conditions                                                 | Min  | Max      | Unit |
|-----------|-------------------------|------------------------------------------------------------|------|----------|------|
| $V_{CC}$  | supply voltage          |                                                            | -0.5 | +7       | V    |
| $I_{IK}$  | input clamping current  | $V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$ [1] | -    | $\pm 20$ | mA   |
| $I_{OK}$  | output clamping current | $V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ [1] | -    | $\pm 20$ | mA   |
| $I_O$     | output current          | $-0.5\text{ V} < V_O < V_{CC} + 0.5\text{ V}$              | -    | $\pm 25$ | mA   |
| $I_{CC}$  | supply current          |                                                            | -    | 50       | mA   |
| $I_{GND}$ | ground current          |                                                            | -50  | -        | mA   |
| $T_{stg}$ | storage temperature     |                                                            | -65  | +150     | °C   |
| $P_{tot}$ | total power dissipation | $T_{amb} = -40\text{ °C to }+125\text{ °C}$                |      |          |      |
|           |                         | SOT109-1 (SO16) [2]                                        |      |          |      |
|           |                         | SOT403-1 (TSSOP16) [3]                                     | -    | 500      | mW   |
|           |                         | SOT763-1 (DHVQFN16) [4]                                    |      |          |      |
|           |                         | SOT8016-1 (DHXQFN16)                                       | -    | 250      | mW   |

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.  
[2] For SOT109-1 (SO16) package:  $P_{tot}$  derates linearly with 12.4 mW/K above 110 °C.  
[3] For SOT403-1 (TSSOP16) package:  $P_{tot}$  derates linearly with 8.5 mW/K above 91 °C.  
[4] For SOT763-1 (DHVQFN16) package:  $P_{tot}$  derates linearly with 11.2 mW/K above 106 °C.

9. Recommended operating conditions

Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V)

| Symbol           | Parameter                           | Conditions              | 74HC165 |      |                 | 74HCT165 |      |                 | 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     | -    | +125            | -40      | -    | +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 |

10. Static characteristics

Table 6. Static characteristics

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

| Symbol          | Parameter                 | Conditions                                                                             | 25 °C |      |      | -40 °C to +85 °C |      | -40 °C to +125 °C |      | Unit |
|-----------------|---------------------------|----------------------------------------------------------------------------------------|-------|------|------|------------------|------|-------------------|------|------|
|                 |                           |                                                                                        | Min   | Typ  | Max  | Min              | Max  | Min               | Max  |      |
| 74HC165         |                           |                                                                                        |       |      |      |                  |      |                   |      |      |
| V <sub>IH</sub> | HIGH-level input voltage  | V <sub>CC</sub> = 2.0 V                                                                | 1.5   | 1.2  | -    | 1.5              | -    | 1.5               | -    | V    |
|                 |                           | V <sub>CC</sub> = 4.5 V                                                                | 3.15  | 2.4  | -    | 3.15             | -    | 3.15              | -    | V    |
|                 |                           | V <sub>CC</sub> = 6.0 V                                                                | 4.2   | 3.2  | -    | 4.2              | -    | 4.2               | -    | V    |
| V <sub>IL</sub> | LOW-level input voltage   | V <sub>CC</sub> = 2.0 V                                                                | -     | 0.8  | 0.5  | -                | 0.5  | -                 | 0.5  | V    |
|                 |                           | V <sub>CC</sub> = 4.5 V                                                                | -     | 2.1  | 1.35 | -                | 1.35 | -                 | 1.35 | V    |
|                 |                           | V <sub>CC</sub> = 6.0 V                                                                | -     | 2.8  | 1.8  | -                | 1.8  | -                 | 1.8  | V    |
| V <sub>OH</sub> | HIGH-level output voltage | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                    |       |      |      |                  |      |                   |      |      |
|                 |                           | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 2.0 V                                       | 1.9   | 2.0  | -    | 1.9              | -    | 1.9               | -    | V    |
|                 |                           | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 4.5 V                                       | 4.4   | 4.5  | -    | 4.4              | -    | 4.4               | -    | V    |
|                 |                           | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 6.0 V                                       | 5.9   | 6.0  | -    | 5.9              | -    | 5.9               | -    | V    |
|                 |                           | I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V                                      | 3.98  | 4.32 | -    | 3.84             | -    | 3.7               | -    | V    |
|                 |                           | I <sub>O</sub> = -5.2 mA; V <sub>CC</sub> = 6.0 V                                      | 5.48  | 5.81 | -    | 5.34             | -    | 5.2               | -    | V    |
| V <sub>OL</sub> | LOW-level output voltage  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                    |       |      |      |                  |      |                   |      |      |
|                 |                           | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 2.0 V                                        | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V                                        | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V                                        | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V                                       | -     | 0.15 | 0.26 | -                | 0.33 | -                 | 0.4  | V    |
|                 |                           | I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V                                       | -     | 0.16 | 0.26 | -                | 0.33 | -                 | 0.4  | V    |
| I <sub>I</sub>  | input leakage current     | V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V                       | -     | -    | ±0.1 | -                | ±1   | -                 | ±1   | μA   |
| I <sub>CC</sub> | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 6.0 V | -     | -    | 8.0  | -                | 80   | -                 | 160  | μA   |
| C <sub>I</sub>  | input capacitance         |                                                                                        | -     | 3.5  | -    | -                | -    | -                 | -    | pF   |

| Symbol           | Parameter                 | Conditions                                                                                                                        | 25 °C |      |      | -40 °C to +85 °C |       | -40 °C to +125 °C |       | Unit |
|------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------|------|------|------------------|-------|-------------------|-------|------|
|                  |                           |                                                                                                                                   | Min   | Typ  | Max  | Min              | Max   | Min               | Max   |      |
| 74HCT165         |                           |                                                                                                                                   |       |      |      |                  |       |                   |       |      |
| V <sub>IH</sub>  | HIGH-level input voltage  | V <sub>CC</sub> = 4.5 V to 5.5 V                                                                                                  | 2.0   | 1.6  | -    | 2.0              | -     | 2.0               | -     | V    |
| V <sub>IL</sub>  | LOW-level input voltage   | V <sub>CC</sub> = 4.5 V to 5.5 V                                                                                                  | -     | 1.2  | 0.8  | -                | 0.8   | -                 | 0.8   | V    |
| V <sub>OH</sub>  | HIGH-level output voltage | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V                                                     |       |      |      |                  |       |                   |       |      |
|                  |                           | I <sub>O</sub> = -20 µA                                                                                                           | 4.4   | 4.5  | -    | 4.4              | -     | 4.4               | -     | V    |
|                  |                           | I <sub>O</sub> = -4.0 mA                                                                                                          | 3.98  | 4.32 | -    | 3.84             | -     | 3.7               | -     | V    |
| V <sub>OL</sub>  | LOW-level output voltage  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                                                               |       |      |      |                  |       |                   |       |      |
|                  |                           | I <sub>O</sub> = 20 µA; V <sub>CC</sub> = 4.5 V                                                                                   | -     | 0    | 0.1  | -                | 0.1   | -                 | 0.1   | V    |
|                  |                           | I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V                                                                                  | -     | 0.16 | 0.26 | -                | 0.33  | -                 | 0.4   | V    |
| I <sub>I</sub>   | input leakage current     | V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V                                                                  | -     | -    | ±0.1 | -                | ±1    | -                 | ±1    | µA   |
| I <sub>CC</sub>  | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 6.0 V                                            | -     | -    | 8.0  | -                | 80    | -                 | 160   | µA   |
| ΔI <sub>CC</sub> | additional supply current | per input pin; V <sub>I</sub> = V <sub>CC</sub> - 2.1 V; other inputs at V <sub>CC</sub> or GND; V <sub>CC</sub> = 4.5 V to 5.5 V |       |      |      |                  |       |                   |       |      |
|                  |                           | Dn and DS inputs                                                                                                                  | -     | 35   | 126  | -                | 157.5 | -                 | 171.5 | µA   |
|                  |                           | CP, $\overline{\text{CE}}$ , and $\overline{\text{PL}}$ inputs                                                                    | -     | 65   | 234  | -                | 292.5 | -                 | 318.5 | µA   |
| C <sub>I</sub>   | input capacitance         |                                                                                                                                   | -     | 3.5  | -    | -                | -     | -                 | -     | pF   |

## 11. Dynamic characteristics

**Table 7. Dynamic characteristics**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V);

$C_L = 50$  pF unless otherwise specified; for test circuit, see [Fig. 10](#)

| Symbol                  | Parameter         | Conditions                                                                    | 25 °C |     |     | -40 °C to +85 °C |     | -40 °C to +125 °C |     | Unit |
|-------------------------|-------------------|-------------------------------------------------------------------------------|-------|-----|-----|------------------|-----|-------------------|-----|------|
|                         |                   |                                                                               | Min   | Typ | Max | Min              | Max | Min               | Max |      |
| 74HC165                 |                   |                                                                               |       |     |     |                  |     |                   |     |      |
| t <sub>pd</sub>         | propagation delay | CP or $\overline{CE}$ to Q7, $\overline{Q7}$ ; see <a href="#">Fig. 5</a> [1] |       |     |     |                  |     |                   |     |      |
|                         |                   | V <sub>CC</sub> = 2.0 V                                                       | -     | 52  | 165 | -                | 205 | -                 | 250 | ns   |
|                         |                   | V <sub>CC</sub> = 4.5 V                                                       | -     | 19  | 33  | -                | 41  | -                 | 50  | ns   |
|                         |                   | V <sub>CC</sub> = 6.0 V                                                       | -     | 15  | 28  | -                | 35  | -                 | 43  | ns   |
|                         |                   | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF                               | -     | 16  | -   | -                | -   | -                 | -   | ns   |
|                         |                   | $\overline{PL}$ to Q7, $\overline{Q7}$ ; see <a href="#">Fig. 6</a>           |       |     |     |                  |     |                   |     |      |
|                         |                   | V <sub>CC</sub> = 2.0 V                                                       | -     | 50  | 165 | -                | 205 | -                 | 250 | ns   |
|                         |                   | V <sub>CC</sub> = 4.5 V                                                       | -     | 18  | 33  | -                | 41  | -                 | 50  | ns   |
|                         |                   | V <sub>CC</sub> = 6.0 V                                                       | -     | 14  | 28  | -                | 35  | -                 | 43  | ns   |
|                         |                   | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF                               | -     | 15  | -   | -                | -   | -                 | -   | ns   |
|                         |                   | D7 to Q7, $\overline{Q7}$ ; see <a href="#">Fig. 7</a>                        |       |     |     |                  |     |                   |     |      |
|                         |                   | V <sub>CC</sub> = 2.0 V                                                       | -     | 36  | 120 | -                | 150 | -                 | 180 | ns   |
|                         |                   | V <sub>CC</sub> = 4.5 V                                                       | -     | 13  | 24  | -                | 30  | -                 | 36  | ns   |
|                         |                   | V <sub>CC</sub> = 6.0 V                                                       | -     | 10  | 20  | -                | 26  | -                 | 31  | ns   |
|                         |                   | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF                               | -     | 11  | -   | -                | -   | -                 | -   | ns   |
| t <sub>t</sub>          | transition time   | Q7, $\overline{Q7}$ output; see <a href="#">Fig. 5</a> [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       | CP input HIGH or LOW; see <a href="#">Fig. 5</a>                              |       |     |     |                  |     |                   |     |      |
|                         |                   | 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   |
|                         |                   | $\overline{PL}$ input LOW; see <a href="#">Fig. 6</a>                         |       |     |     |                  |     |                   |     |      |
|                         |                   | V <sub>CC</sub> = 2.0 V                                                       | 80    | 14  | -   | 100              | -   | 120               | -   | ns   |
|                         |                   | V <sub>CC</sub> = 4.5 V                                                       | 16    | 5   | -   | 20               | -   | 24                | -   | ns   |
| V <sub>CC</sub> = 6.0 V | 14                | 4                                                                             | -     | 17  | -   | 20               | -   | ns                |     |      |
| t <sub>rec</sub>        | recovery time     | $\overline{PL}$ to CP, $\overline{CE}$ ; see <a href="#">Fig. 6</a>           |       |     |     |                  |     |                   |     |      |
|                         |                   | V <sub>CC</sub> = 2.0 V                                                       | 100   | 22  | -   | 125              | -   | 150               | -   | ns   |
|                         |                   | V <sub>CC</sub> = 4.5 V                                                       | 20    | 8   | -   | 25               | -   | 30                | -   | ns   |
|                         |                   | V <sub>CC</sub> = 6.0 V                                                       | 17    | 6   | -   | 21               | -   | 26                | -   | ns   |

| Symbol          | Parameter                     | Conditions                                                       | 25 °C |     |     | -40 °C to +85 °C |     | -40 °C to +125 °C |     | Unit |
|-----------------|-------------------------------|------------------------------------------------------------------|-------|-----|-----|------------------|-----|-------------------|-----|------|
|                 |                               |                                                                  | Min   | Typ | Max | Min              | Max | Min               | Max |      |
| $t_{su}$        | set-up time                   | DS to CP, $\overline{CE}$ ; see Fig. 8                           |       |     |     |                  |     |                   |     |      |
|                 |                               | $V_{CC} = 2.0\text{ V}$                                          | 80    | 11  | -   | 100              | -   | 120               | -   | ns   |
|                 |                               | $V_{CC} = 4.5\text{ V}$                                          | 16    | 4   | -   | 20               | -   | 24                | -   | ns   |
|                 |                               | $V_{CC} = 6.0\text{ V}$                                          | 14    | 3   | -   | 17               | -   | 20                | -   | ns   |
|                 |                               | $\overline{CE}$ to CP and CP to $\overline{CE}$ ; see Fig. 8     |       |     |     |                  |     |                   |     |      |
|                 |                               | $V_{CC} = 2.0\text{ V}$                                          | 80    | 17  | -   | 100              | -   | 120               | -   | ns   |
|                 |                               | $V_{CC} = 4.5\text{ V}$                                          | 16    | 6   | -   | 20               | -   | 24                | -   | ns   |
|                 |                               | $V_{CC} = 6.0\text{ V}$                                          | 14    | 5   | -   | 17               | -   | 20                | -   | ns   |
|                 |                               | Dn to $\overline{PL}$ ; see Fig. 9                               |       |     |     |                  |     |                   |     |      |
|                 |                               | $V_{CC} = 2.0\text{ V}$                                          | 80    | 22  | -   | 100              | -   | 120               | -   | ns   |
|                 |                               | $V_{CC} = 4.5\text{ V}$                                          | 16    | 8   | -   | 20               | -   | 24                | -   | ns   |
|                 |                               | $V_{CC} = 6.0\text{ V}$                                          | 14    | 6   | -   | 17               | -   | 20                | -   | ns   |
| $t_h$           | hold time                     | DS to CP, $\overline{CE}$ and Dn to $\overline{PL}$ ; see Fig. 8 |       |     |     |                  |     |                   |     |      |
|                 |                               | $V_{CC} = 2.0\text{ V}$                                          | 5     | 2   | -   | 5                | -   | 5                 | -   | ns   |
|                 |                               | $V_{CC} = 4.5\text{ V}$                                          | 5     | 2   | -   | 5                | -   | 5                 | -   | ns   |
|                 |                               | $V_{CC} = 6.0\text{ V}$                                          | 5     | 2   | -   | 5                | -   | 5                 | -   | ns   |
|                 |                               | $\overline{CE}$ to CP and CP to $\overline{CE}$ ; see Fig. 8     |       |     |     |                  |     |                   |     |      |
|                 |                               | $V_{CC} = 2.0\text{ V}$                                          | 5     | -17 | -   | 5                | -   | 5                 | -   | ns   |
|                 |                               | $V_{CC} = 4.5\text{ V}$                                          | 5     | -6  | -   | 5                | -   | 5                 | -   | ns   |
|                 |                               | $V_{CC} = 6.0\text{ V}$                                          | 5     | -5  | -   | 5                | -   | 5                 | -   | ns   |
| $f_{max}$       | maximum frequency             | CP input; see Fig. 5                                             |       |     |     |                  |     |                   |     |      |
|                 |                               | $V_{CC} = 2.0\text{ V}$                                          | 6     | 17  | -   | 5                | -   | 4                 | -   | MHz  |
|                 |                               | $V_{CC} = 4.5\text{ V}$                                          | 30    | 51  | -   | 24               | -   | 20                | -   | MHz  |
|                 |                               | $V_{CC} = 6.0\text{ V}$                                          | 35    | 61  | -   | 28               | -   | 24                | -   | MHz  |
|                 |                               | $V_{CC} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$                   | -     | 56  | -   | -                | -   | -                 | -   | MHz  |
| $C_{PD}$        | power dissipation capacitance | per package; $V_I = \text{GND to } V_{CC}$ [3]                   | -     | 35  | -   | -                | -   | -                 | -   | pF   |
| <b>74HCT165</b> |                               |                                                                  |       |     |     |                  |     |                   |     |      |
| $t_{pd}$        | propagation delay             | $\overline{CE}$ , CP to Q7, $\overline{Q7}$ ; see Fig. 5 [1]     |       |     |     |                  |     |                   |     |      |
|                 |                               | $V_{CC} = 4.5\text{ V}$                                          | -     | 17  | 34  | -                | 43  | -                 | 51  | ns   |
|                 |                               | $V_{CC} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$                   | -     | 14  | -   | -                | -   | -                 | -   | ns   |
|                 |                               | $\overline{PL}$ to Q7, $\overline{Q7}$ ; see Fig. 6              |       |     |     |                  |     |                   |     |      |
|                 |                               | $V_{CC} = 4.5\text{ V}$                                          | -     | 20  | 40  | -                | 50  | -                 | 60  | ns   |
|                 |                               | $V_{CC} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$                   | -     | 17  | -   | -                | -   | -                 | -   | ns   |
|                 |                               | D7 to Q7, $\overline{Q7}$ ; see Fig. 7                           |       |     |     |                  |     |                   |     |      |
|                 |                               | $V_{CC} = 4.5\text{ V}$                                          | -     | 14  | 28  | -                | 35  | -                 | 42  | ns   |
|                 |                               | $V_{CC} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$                   | -     | 11  | -   | -                | -   | -                 | -   | ns   |

| Symbol    | Parameter                     | Conditions                                                       | 25 °C |     |     | -40 °C to +85 °C |     | -40 °C to +125 °C |     | Unit |
|-----------|-------------------------------|------------------------------------------------------------------|-------|-----|-----|------------------|-----|-------------------|-----|------|
|           |                               |                                                                  | Min   | Typ | Max | Min              | Max | Min               | Max |      |
| $t_t$     | transition time               | Q7, $\overline{Q7}$ output; see Fig. 5 [2]                       |       |     |     |                  |     |                   |     |      |
|           |                               | $V_{CC} = 4.5\text{ V}$                                          | -     | 7   | 15  | -                | 19  | -                 | 22  | ns   |
| $t_W$     | pulse width                   | CP input; see Fig. 5                                             |       |     |     |                  |     |                   |     |      |
|           |                               | $V_{CC} = 4.5\text{ V}$                                          | 16    | 6   | -   | 20               | -   | 24                | -   | ns   |
|           |                               | $\overline{PL}$ input; see Fig. 6                                |       |     |     |                  |     |                   |     |      |
|           |                               | $V_{CC} = 4.5\text{ V}$                                          | 20    | 9   | -   | 25               | -   | 30                | -   | ns   |
| $t_{rec}$ | recovery time                 | $\overline{PL}$ to CP, $\overline{CE}$ ; see Fig. 6              |       |     |     |                  |     |                   |     |      |
|           |                               | $V_{CC} = 4.5\text{ V}$                                          | 20    | 8   | -   | 25               | -   | 30                | -   | ns   |
| $t_{su}$  | set-up time                   | DS to CP, $\overline{CE}$ ; see Fig. 8                           |       |     |     |                  |     |                   |     |      |
|           |                               | $V_{CC} = 4.5\text{ V}$                                          | 20    | 2   | -   | 25               | -   | 30                | -   | ns   |
|           |                               | $\overline{CE}$ to CP and CP to $\overline{CE}$ ; see Fig. 8     |       |     |     |                  |     |                   |     |      |
|           |                               | $V_{CC} = 4.5\text{ V}$                                          | 20    | 7   | -   | 25               | -   | 30                | -   | ns   |
|           |                               | Dn to $\overline{PL}$ ; see Fig. 9                               |       |     |     |                  |     |                   |     |      |
| $t_h$     | hold time                     | $V_{CC} = 4.5\text{ V}$                                          | 20    | 10  | -   | 25               | -   | 30                | -   | ns   |
|           |                               | DS to CP, $\overline{CE}$ and Dn to $\overline{PL}$ ; see Fig. 8 |       |     |     |                  |     |                   |     |      |
|           |                               | $V_{CC} = 4.5\text{ V}$                                          | 7     | -1  | -   | 9                | -   | 11                | -   | ns   |
|           |                               | $\overline{CE}$ to CP and CP to $\overline{CE}$ ; see Fig. 8     |       |     |     |                  |     |                   |     |      |
| $f_{max}$ | maximum frequency             | $V_{CC} = 4.5\text{ V}$                                          | 0     | -7  | -   | 0                | -   | 0                 | -   | ns   |
|           |                               | CP input; see Fig. 5                                             |       |     |     |                  |     |                   |     |      |
|           |                               | $V_{CC} = 4.5\text{ V}$                                          | 26    | 44  | -   | 21               | -   | 17                | -   | MHz  |
| $C_{PD}$  | power dissipation capacitance | $V_{CC} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$                   | -     | 48  | -   | -                | -   | -                 | -   | MHz  |
|           |                               | per package; $V_I = \text{GND to } V_{CC} - 1.5\text{ V}$ [3]    | -     | 35  | -   | -                | -   | -                 | -   | pF   |

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

[2]  $t_t$  is the same as  $t_{THL}$  and  $t_{TLH}$ .

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

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

$f_i$  = input frequency in MHz;

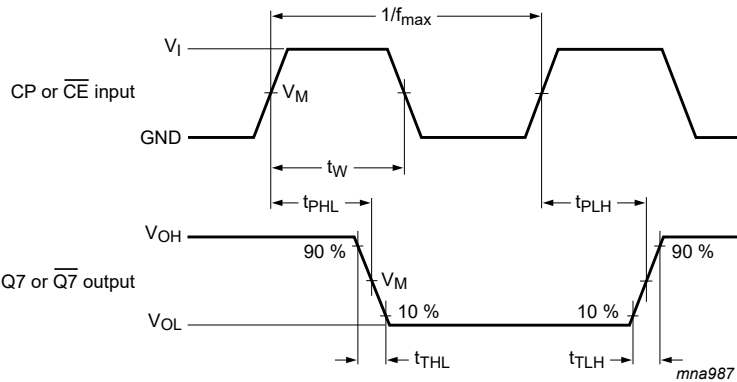
$f_o$  = output frequency in MHz;

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

$C_L$  = output load capacitance in pF;

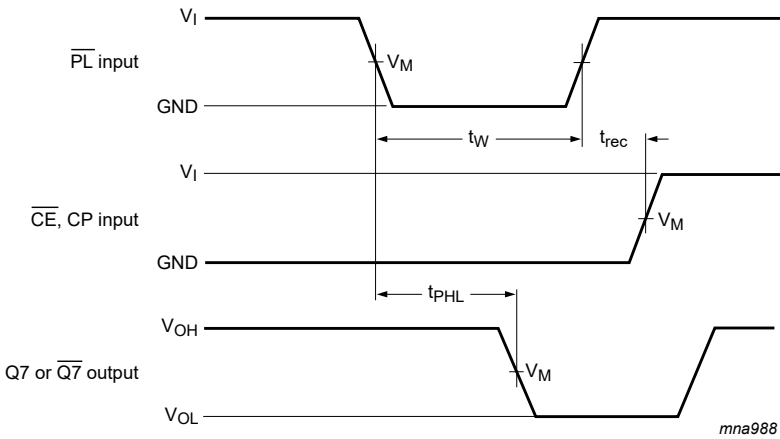
$V_{CC}$  = supply voltage in V.

11.1. Waveforms and test circuit



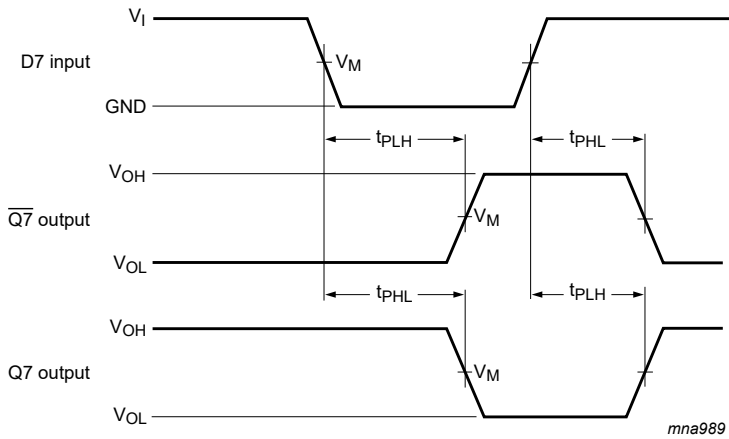
Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.

Fig. 5. The clock (CP) or clock enable ( $\overline{CE}$ ) to output (Q7 or  $\overline{Q7}$ ) propagation delays, the clock pulse width, the maximum clock frequency and the output transition times



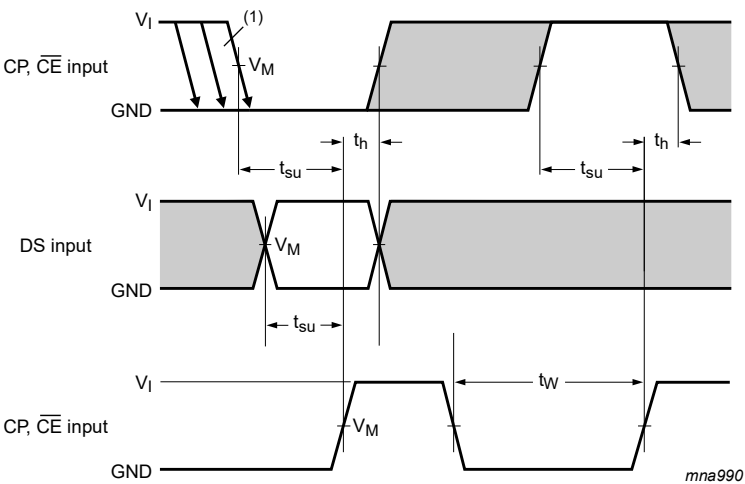
Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.

Fig. 6. The parallel load ( $\overline{PL}$ ) pulse width, the parallel load to output (Q7 or  $\overline{Q7}$ ) propagation delays, the parallel load to clock (CP) and clock enable ( $\overline{CE}$ ) recovery time



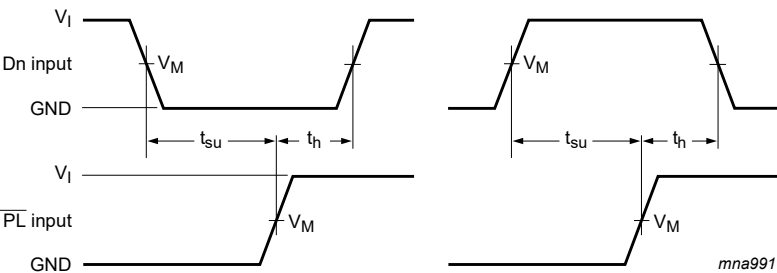
Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.

Fig. 7. The data input (D7) to output (Q7 or  $\overline{Q7}$ ) propagation delays when  $\overline{PL}$  is LOW



(1)  $\overline{CE}$  may change only from HIGH-to-LOW while CP is LOW.  
The shaded areas indicate when the input is permitted to change for predictable output performance  
Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.

**Fig. 8.** The set-up and hold times from the serial data input (DS) to the clock (CP) and clock enable ( $\overline{CE}$ ) inputs, from the clock enable input ( $\overline{CE}$ ) to the clock input (CP) and from the clock input (CP) to the clock enable input ( $\overline{CE}$ )

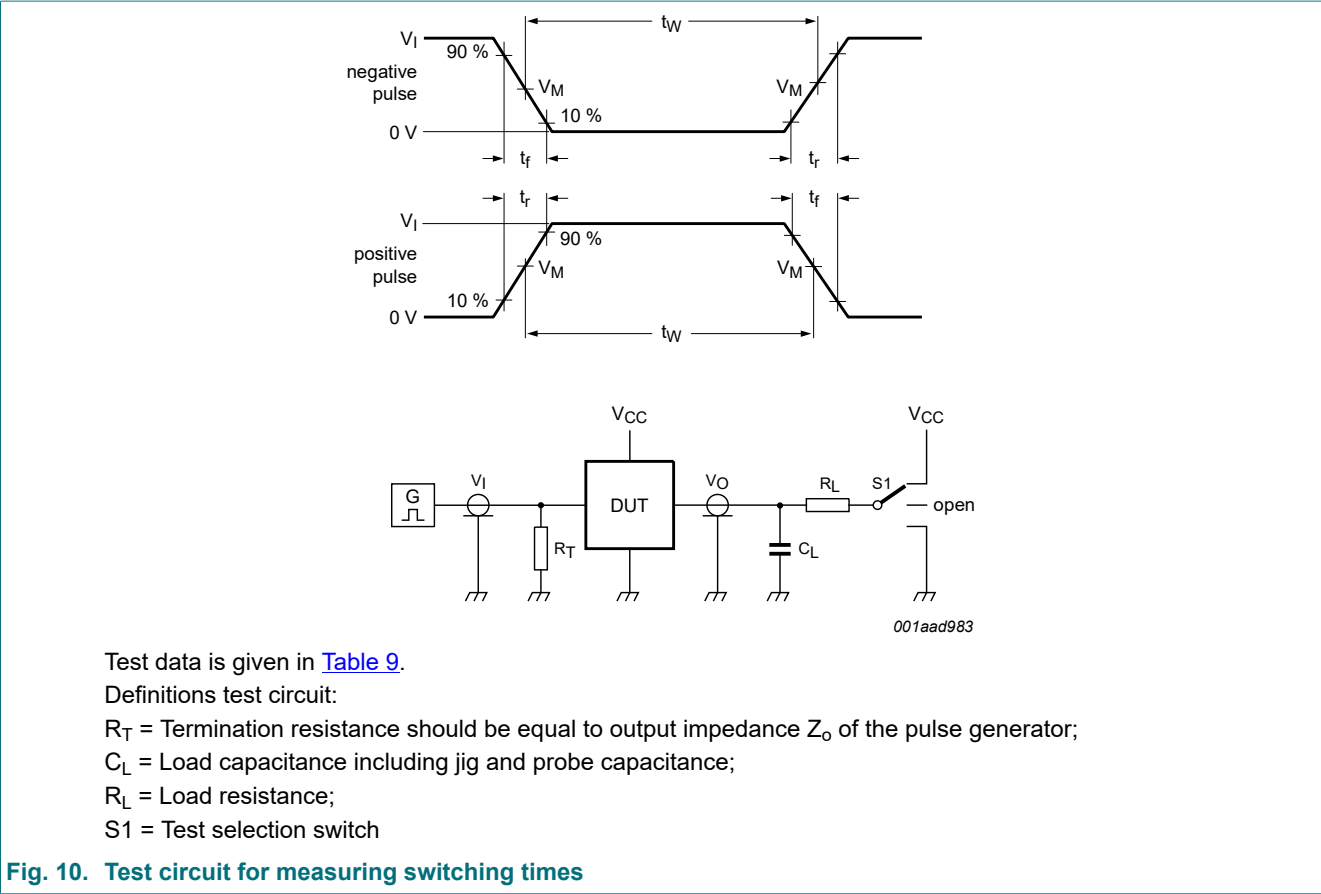


Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.

**Fig. 9.** The set-up and hold times from the data inputs (Dn) to the parallel load input ( $\overline{PL}$ )

**Table 8. Measurement points**

| Type     | Input    |             | Output      |
|----------|----------|-------------|-------------|
|          | $V_I$    | $V_M$       | $V_M$       |
| 74HC165  | $V_{CC}$ | $0.5V_{CC}$ | $0.5V_{CC}$ |
| 74HCT165 | 3 V      | 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;  
 $R_L$  = Load resistance;  
 $S1$  = Test selection switch

Fig. 10. Test circuit for measuring switching times

Table 9. Test data

| Type     | Input    |            | Load         |              | S1 position |
|----------|----------|------------|--------------|--------------|-------------|
|          | $V_I$    | $t_r, t_f$ | $C_L$        | $R_L$        |             |
| 74HC165  | $V_{CC}$ | 6 ns       | 15 pF, 50 pF | 1 k $\Omega$ | open        |
| 74HCT165 | 3 V      | 6 ns       | 15 pF, 50 pF | 1 k $\Omega$ | open        |

12. Package outline

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

SOT109-1

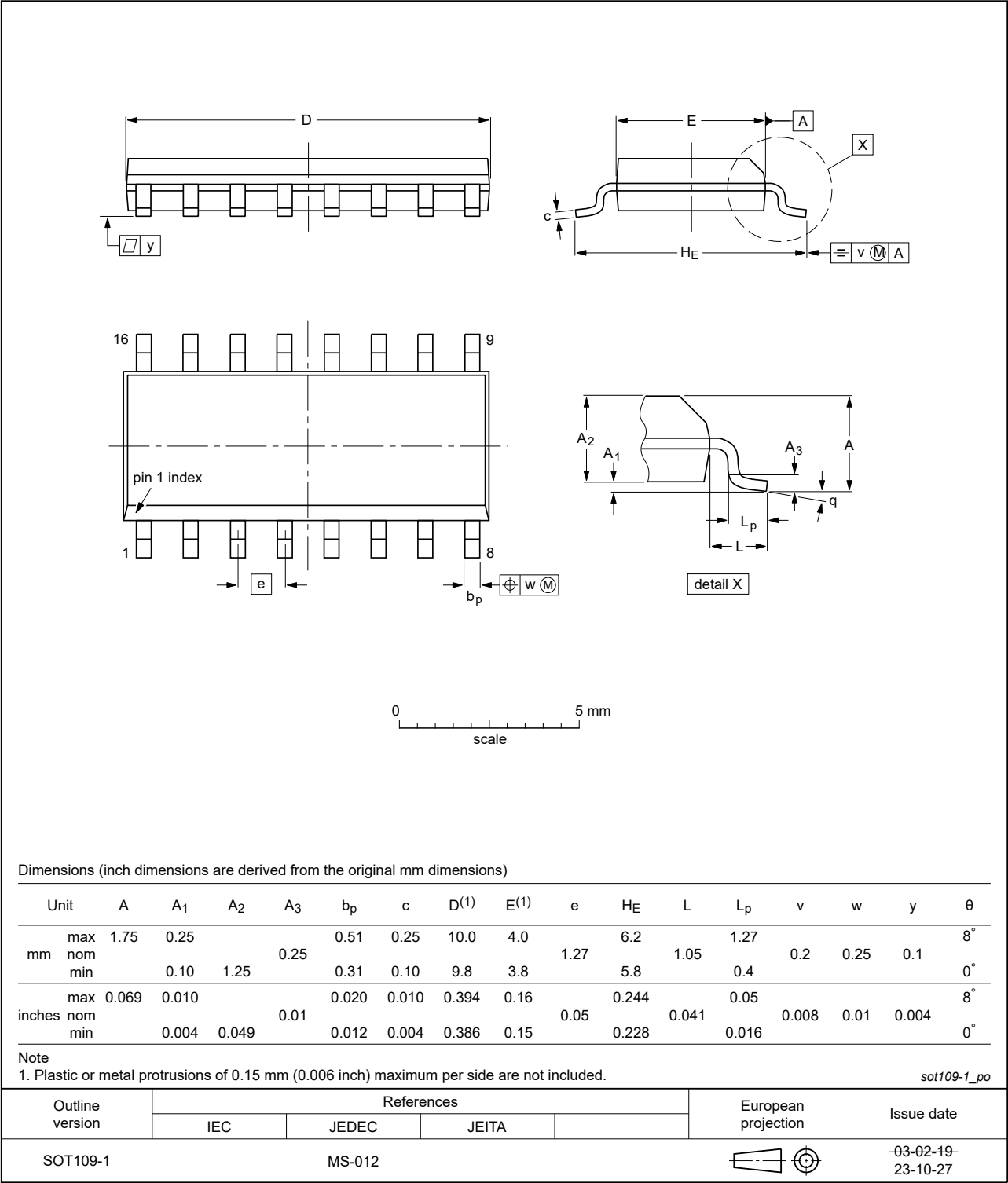


Fig. 11. Package outline SOT109-1 (SO16)

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

SOT403-1

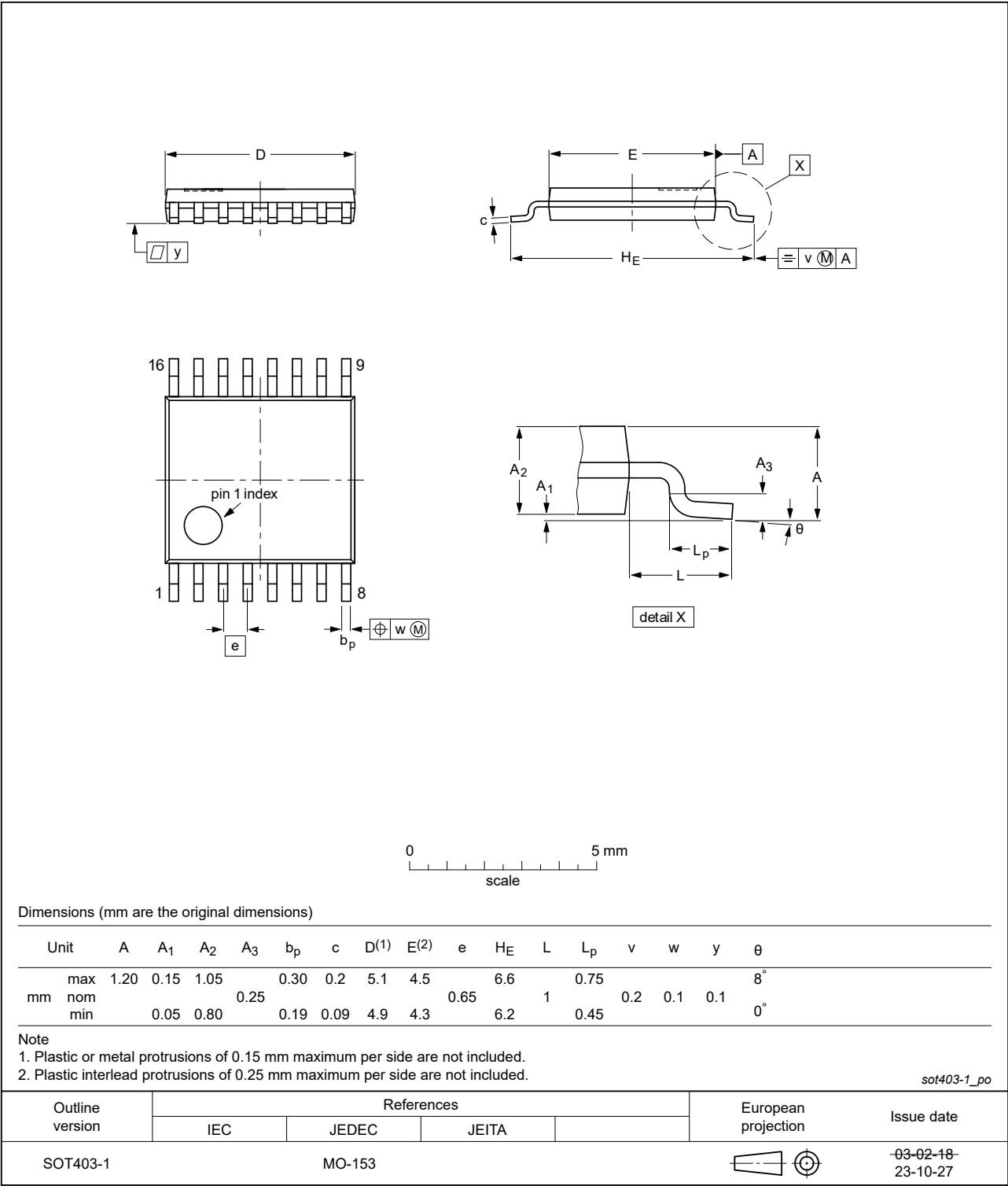


Fig. 12. Package outline SOT403-1 (TSSOP16)

DHVQFN16: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads;  
16 terminals; body 2.5 x 3.5 x 0.85 mm SOT763-1

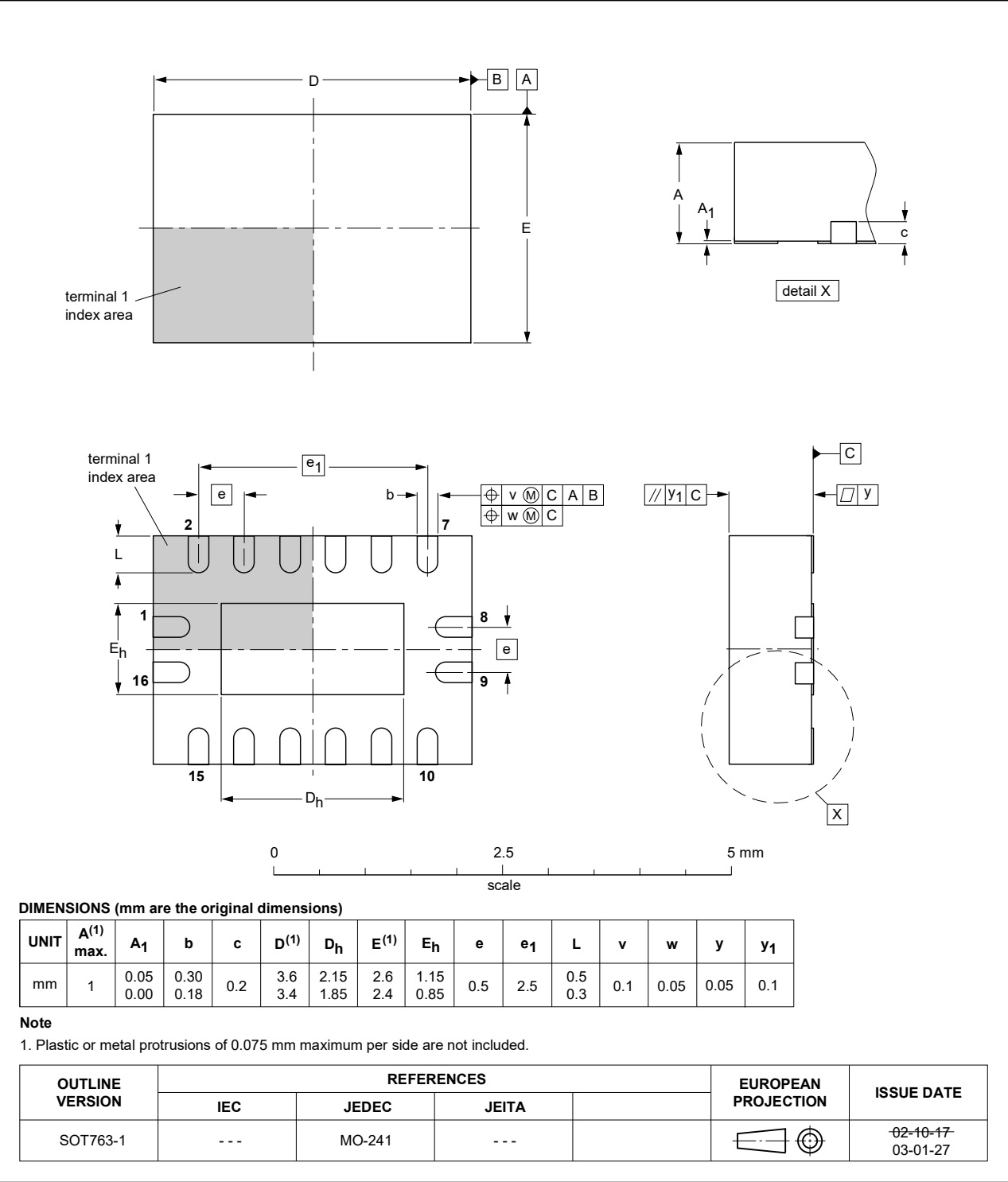


Fig. 13. Package outline SOT763-1 (DHVQFN16)

DHXQFN16: plastic, leadless dual in-line compatible thermal enhanced extreme thin quad flat package;  
 no leads; 16 terminals; 0.4 mm pitch; body 2 mm x 2.4 mm x 0.48 mm

SOT8016-1

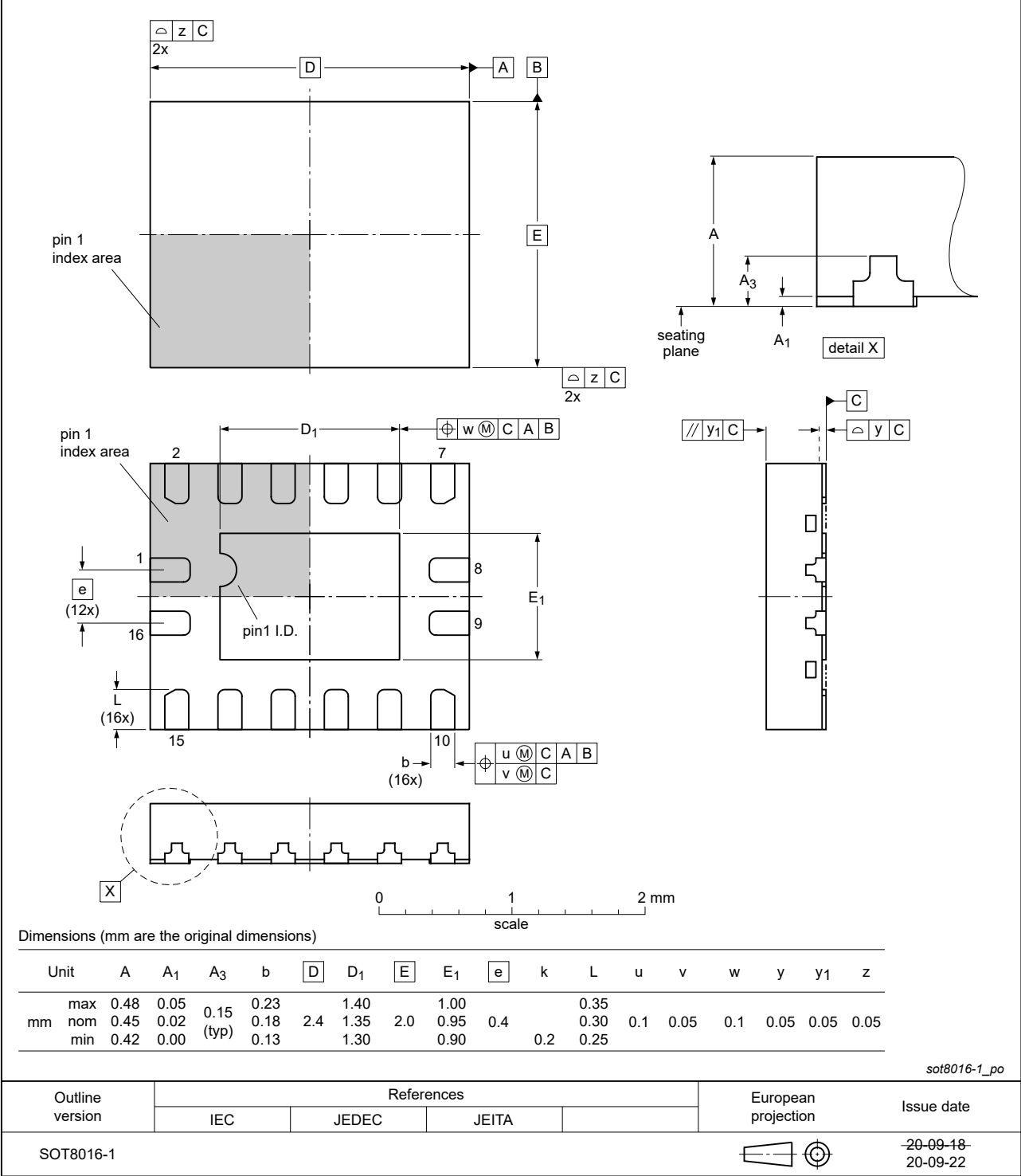


Fig. 14. Package outline SOT8016-1 (DHXQFN16)

## 13. Abbreviations

Table 10. Abbreviations

| Acronym | Description                               |
|---------|-------------------------------------------|
| ANSI    | American National Standards Institute     |
| CDM     | Charged Device Model                      |
| CMOS    | Complementary Metal-Oxide Semiconductor   |
| DUT     | Device Under Test                         |
| ESD     | ElectroStatic Discharge                   |
| ESDA    | ElectroStatic Discharge Association       |
| HBM     | Human Body Model                          |
| JEDEC   | Joint Electron Device Engineering Council |
| TTL     | Transistor-Transistor Logic               |

## 14. Revision history

Table 11. Revision history

| Document ID         | Release date                                                                                                                                                                                                                                                                                                                                                                                                               | Data sheet status     | Change notice | Supersedes          |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|---------------------|
| 74HC_HCT165 v.8     | 20250509                                                                                                                                                                                                                                                                                                                                                                                                                   | Product data sheet    | -             | 74HC_HCT165 v.7     |
| Modifications:      | <ul style="list-style-type: none"> <li>Type numbers 74HC165BZ and 74HCT165BZ (SOT8016-1/DHXQFN16) added.</li> <li><a href="#">Fig. 11</a>, <a href="#">Fig. 12</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_HCT165 v.7     | 20210901                                                                                                                                                                                                                                                                                                                                                                                                                   | Product data sheet    | -             | 74HC_HCT165 v.6     |
| Modifications:      | <ul style="list-style-type: none"> <li><a href="#">Section 2</a> updated.</li> <li>Type numbers 74HC165DB and 74HCT165DB (SOT338-1/SSOP16) removed.</li> </ul>                                                                                                                                                                                                                                                             |                       |               |                     |
| 74HC_HCT165 v.6     | 20200423                                                                                                                                                                                                                                                                                                                                                                                                                   | Product data sheet    | -             | 74HC_HCT165 v.5     |
| Modifications:      | <ul style="list-style-type: none"> <li><a href="#">Table 4</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li> </ul>                                                                                                                                                                                                                                                                       |                       |               |                     |
| 74HC_HCT165 v.5     | 20170821                                                                                                                                                                                                                                                                                                                                                                                                                   | Product data sheet    | -             | 74HC_HCT165 v.4     |
| Modifications:      | <ul style="list-style-type: none"> <li><a href="#">Table 7</a>: Hold time for 74HC165 has been updated.</li> <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> </ul>                                                                                                        |                       |               |                     |
| 74HC_HCT165 v.4     | 20151228                                                                                                                                                                                                                                                                                                                                                                                                                   | Product data sheet    | -             | 74HC_HCT165 v.3     |
| Modifications:      | <ul style="list-style-type: none"> <li>Type numbers 74HC165N and 74HCT165N (SOT38-4) removed.</li> </ul>                                                                                                                                                                                                                                                                                                                   |                       |               |                     |
| 74HC_HCT165 v.3     | 20080314                                                                                                                                                                                                                                                                                                                                                                                                                   | Product data sheet    | -             | 74HC_HCT165_CNV v.2 |
| Modifications:      | <ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li>Package SOT763-1 (DHVQFN16) added to <a href="#">Section 4</a> and <a href="#">Section 12</a>.</li> <li>Family data added, see <a href="#">Section 10</a></li> </ul> |                       |               |                     |
| 74HC_HCT165_CNV v.2 | December 1990                                                                                                                                                                                                                                                                                                                                                                                                              | Product specification | -             | -                   |

15. 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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