

# 74LV165

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

Rev. 6 — 19 February 2014

Product data sheet

### 1. General description

The 74LV165 is an 8-bit parallel-load or serial-in shift register with complementary serial outputs ( $Q_7$  and  $\overline{Q_7}$ ) available from the last stage. When the parallel-load input ( $\overline{PL}$ ) is LOW, parallel data from the inputs D0 to D7 are loaded into the register asynchronously. When input  $\overline{PL}$  is HIGH, data enters the register serially at the input DS. It shifts one place to the right ( $Q_0 \rightarrow Q_1 \rightarrow Q_2$ , etc.) with each positive-going clock transition. This feature allows parallel-to-serial converter expansion by tying the output  $Q_7$  to the input DS of the succeeding stage.

The clock input is a gate-OR structure which allows one input to be used as an active LOW clock enable input ( $\overline{CE}$ ) input. The pin assignment for the inputs CP and  $\overline{CE}$  is arbitrary and can be reversed for layout convenience. The LOW-to-HIGH transition of the input  $\overline{CE}$  should only take place while CP HIGH for predictable operation. Either the CP or the  $\overline{CE}$  should be HIGH before the LOW-to-HIGH transition of  $\overline{PL}$  to prevent shifting the data when PL is activated.

### 2. Features and benefits

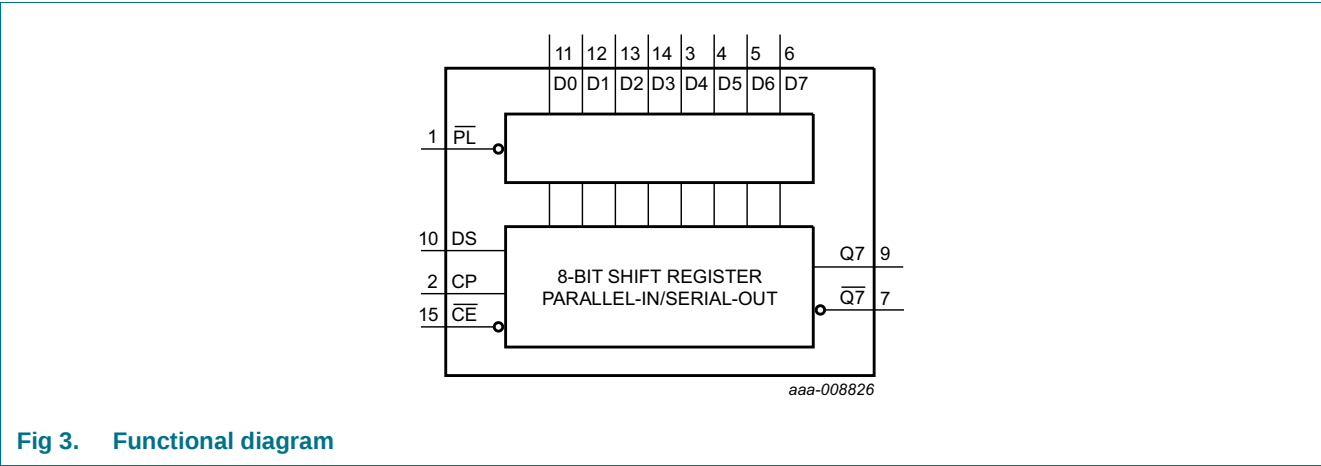
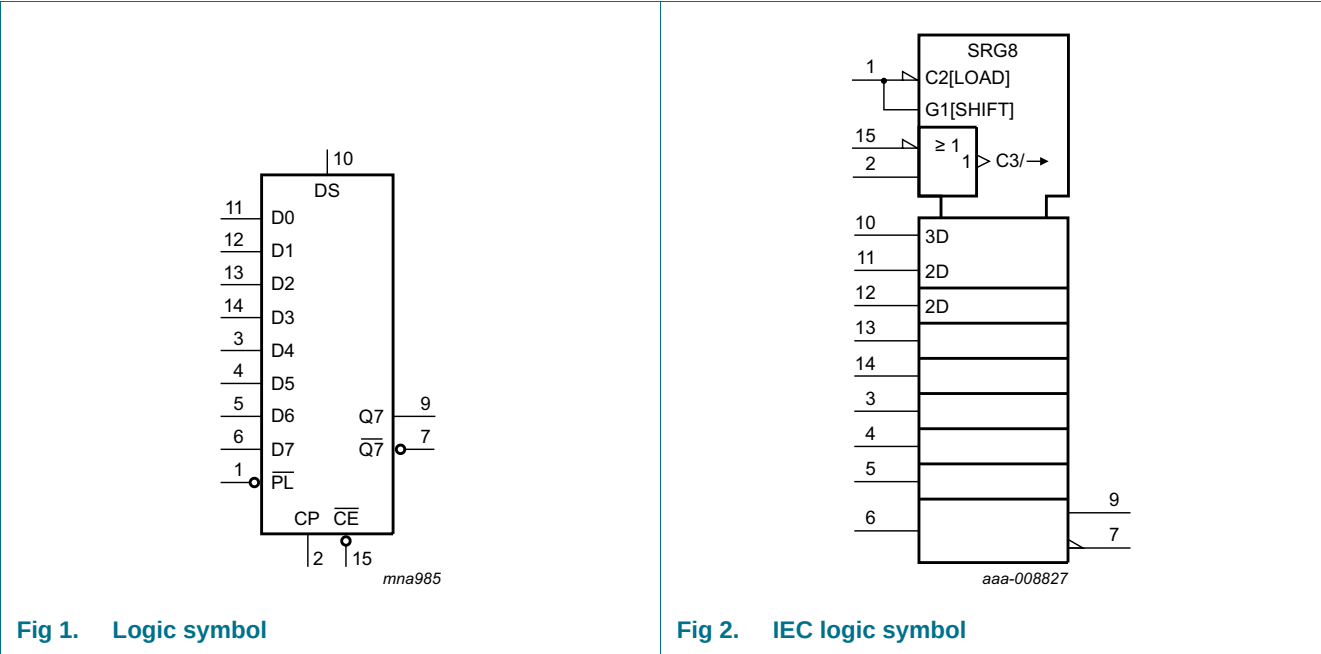
- Wide supply voltage range from 1.0 V to 5.5 V
- Synchronous parallel-to-serial applications
- Optimized for low voltage applications: 1.0 V to 3.6 V
- Synchronous serial input for easy expansion
- Latch-up performance exceeds 250 mA
- 5.5 V tolerant inputs/outputs
- Direct interface with TTL levels (2.7 V to 3.6 V)
- Power-down mode
- Complies with JEDEC standards:
  - ◆ JESD8-5 (2.3 V to 2.7 V)
  - ◆ JESD8B/JESD36 (2.7 V to 3.6 V)
  - ◆ JESD8-1A (4.5 V to 5.5 V)
- ESD protection:
  - ◆ HBM JESD22-A114-A exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
- Specified from  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  and from  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$

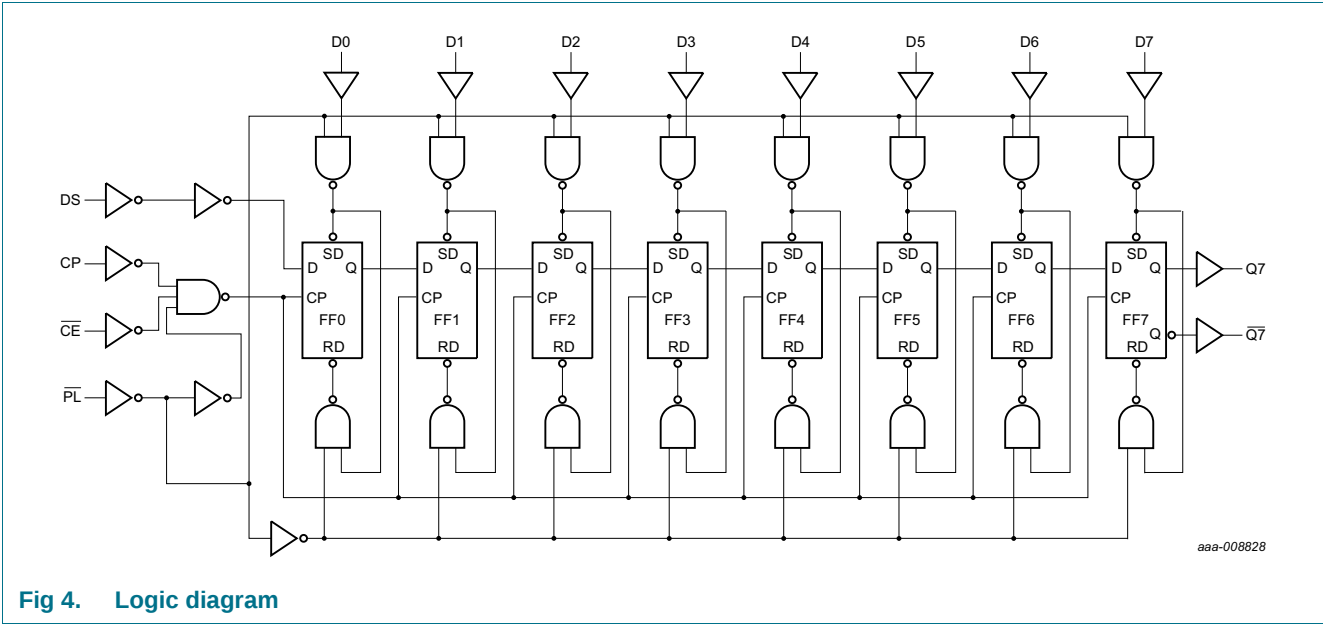


3. Ordering information

| Table 1. Ordering information |                   |         |                                                                        |          |
|-------------------------------|-------------------|---------|------------------------------------------------------------------------|----------|
| Type number                   | Package           |         |                                                                        | Version  |
|                               | Temperature range | Name    | Description                                                            |          |
| 74LV165N                      | −40 °C to +125 °C | DIP16   | plastic dual in-line package; 16 leads (300 mil)                       | SOT38-4  |
| 74LV165D                      | −40 °C to +125 °C | SO16    | plastic small outline package; 16 leads; body width 3.9 mm             | SOT109-1 |
| 74LV165DB                     | −40 °C to +125 °C | SSOP16  | plastic shrink small outline package; 16 leads; body width 5.3 mm      | SOT338-1 |
| 74LV165PW                     | −40 °C to +125 °C | TSSOP16 | plastic thin shrink small outline package; 16 leads; body width 4.4 mm | SOT403-1 |

4. Functional diagram





5. Pinning information

5.1 Pinning

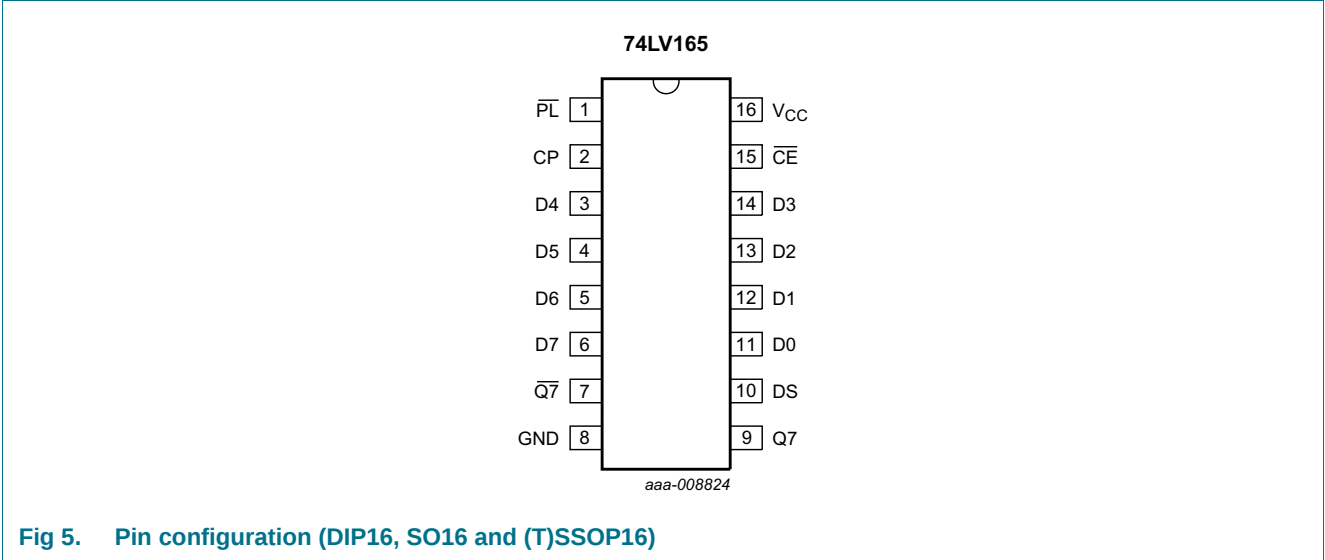


Fig 5. Pin configuration (DIP16, SO16 and (T)SSOP16)

5.2 Pin description

Table 2. Pin description

| Symbol          | Pin                        | Description                                     |
|-----------------|----------------------------|-------------------------------------------------|
| $\overline{PL}$ | 1                          | parallel enable input (active LOW)              |
| CP              | 2                          | clock input (LOW-to-HIGH edge-triggered)        |
| $\overline{Q7}$ | 7                          | complementary serial 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                            |
| $\overline{CE}$ | 15                         | clock enable input (active LOW)                 |
| $V_{CC}$        | 16                         | positive supply voltage                         |

6. Functional description

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

| Operating modes   | Inputs |    |    |    |          | Qn registers |          | Output |                 |
|-------------------|--------|----|----|----|----------|--------------|----------|--------|-----------------|
|                   | PL     | 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     | $\overline{q6}$ |
| hold "do nothing" | H      | H  | X  | X  | X        | q0           | q1 to q6 | q7     | q7              |

[1] H = HIGH voltage level;  
 h = HIGH voltage level one set-up time prior to the LOW-to-HIGH clock transition;  
 L = LOW voltage level;  
 l = LOW voltage level one set-up time prior to the LOW-to-HIGH clock transition;  
 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.

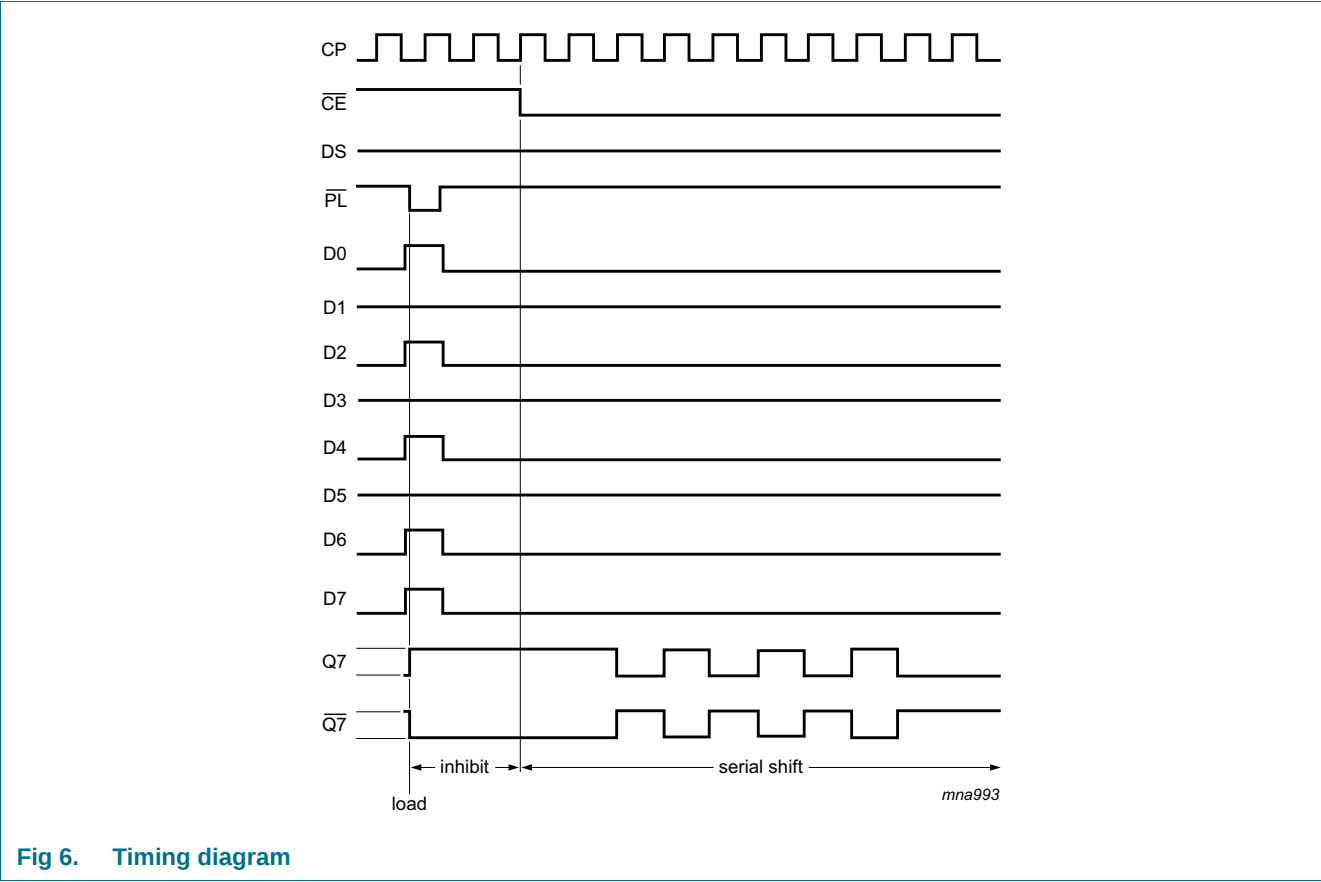


Fig 6. Timing diagram

## 7. Limiting values

**Table 4. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V) <sup>[1]</sup>

| Symbol           | Parameter               | Conditions                                                          | Min              | Max  | Unit |
|------------------|-------------------------|---------------------------------------------------------------------|------------------|------|------|
| V <sub>CC</sub>  | supply voltage          |                                                                     | -0.5             | +7   | V    |
| I <sub>IK</sub>  | input clamping current  | V <sub>I</sub> < -0.5 V or V <sub>I</sub> > V <sub>CC</sub> + 0.5 V | -                | 20   | mA   |
| V <sub>I</sub>   | input voltage           |                                                                     | -0.5             | +7   | V    |
| I <sub>OK</sub>  | output clamping current | V <sub>O</sub> > V <sub>CC</sub> or V <sub>O</sub> < 0              | -                | ±50  | mA   |
| I <sub>O</sub>   | output current          | -0.5 V < V <sub>O</sub> < V <sub>CC</sub> + 0.5 V                   | -                | ±25  | mA   |
| I <sub>CC</sub>  | supply current          |                                                                     | -                | +50  | mA   |
| I <sub>GND</sub> | ground current          |                                                                     | -50              | -    | mA   |
| T <sub>stg</sub> | storage temperature     |                                                                     | -65              | +150 | °C   |
| P <sub>tot</sub> | total power dissipation | T <sub>amb</sub> = -40 °C to +125 °C                                |                  |      |      |
|                  |                         | DIP16 package                                                       | <sup>[2]</sup> - | 750  | mW   |
|                  |                         | SO16 package                                                        | <sup>[3]</sup> - | 500  | mW   |
|                  |                         | (T)SSOP16 package                                                   | <sup>[4]</sup> - | 400  | mW   |

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] P<sub>tot</sub> derates linearly with 12 mW/K above 70 °C.

[3] P<sub>tot</sub> derates linearly with 8 mW/K above 70 °C.

[4] P<sub>tot</sub> derates linearly with 5.5 mW/K above 60 °C.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Voltages are referenced to GND (ground = 0 V)

| Symbol           | Parameter                           | Conditions                       | Min | Typ | Max             | Unit |
|------------------|-------------------------------------|----------------------------------|-----|-----|-----------------|------|
| V <sub>CC</sub>  | supply voltage                      |                                  | 1.0 | 3.3 | 5.5             | V    |
| V <sub>I</sub>   | input voltage                       |                                  | 0   | -   | V <sub>CC</sub> | V    |
| V <sub>O</sub>   | output voltage                      |                                  | 0   | -   | V <sub>CC</sub> | V    |
| T <sub>amb</sub> | ambient temperature                 |                                  | -40 | -   | +85             | °C   |
| Δt/ΔV            | input transition rise and fall rate | V <sub>CC</sub> = 1.0 V to 2.0 V | 0   | -   | 500             | ns/V |
|                  |                                     | V <sub>CC</sub> = 2.0 V to 2.7 V | 0   | -   | 200             | ns/V |
|                  |                                     | V <sub>CC</sub> = 2.7 V to 3.6 V | 0   | -   | 100             | ns/V |
|                  |                                     | V <sub>CC</sub> = 3.6 V to 5.5 V | 0   | -   | 50              | 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 <sup>[1]</sup> | Max                | Min                | Max                |      |
| V <sub>IH</sub>  | HIGH-level input voltage  | V <sub>CC</sub> = 1.2 V                                                                | 0.9                | -                  | -                  | 0.9                | -                  | V    |
|                  |                           | V <sub>CC</sub> = 2.3 V to 2.7 V                                                       | 1.4                | -                  | -                  | 1.4                | -                  | V    |
|                  |                           | V <sub>CC</sub> = 2.7 V to 3.6 V                                                       | 2.0                | -                  | -                  | 2.0                | -                  | V    |
|                  |                           | V <sub>CC</sub> = 4.5 V to 5.5 V                                                       | 0.7V <sub>CC</sub> | -                  | -                  | 0.7V <sub>CC</sub> | -                  | V    |
| V <sub>IL</sub>  | LOW-level input voltage   | V <sub>CC</sub> = 1.2 V                                                                | -                  | -                  | 0.3                | -                  | 0.3                | V    |
|                  |                           | V <sub>CC</sub> = 2.3 V to 2.7 V                                                       | -                  | -                  | 0.6                | -                  | 0.6                | V    |
|                  |                           | V <sub>CC</sub> = 2.7 V to 3.6 V                                                       | -                  | -                  | 0.8                | -                  | 0.8                | V    |
|                  |                           | V <sub>CC</sub> = 4.5 V to 5.5 V                                                       | -                  | -                  | 0.3V <sub>CC</sub> | -                  | 0.3V <sub>CC</sub> |      |
| 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> = 1.2 V                                                                | -                  | 1.2                | -                  | -                  | -                  |      |
|                  |                           | V <sub>CC</sub> = 2.0 V                                                                | 1.8                | 2.0                | -                  | 1.8                | -                  | V    |
|                  |                           | V <sub>CC</sub> = 2.7 V                                                                | 2.5                | 2.7                | -                  | 2.5                | -                  | V    |
|                  |                           | V <sub>CC</sub> = 3.0 V                                                                | 2.8                | 3.0                | -                  | 2.8                | -                  | V    |
|                  |                           | V <sub>CC</sub> = 4.5 V                                                                | 4.3                | 4.5                | -                  | 4.3                | -                  | V    |
|                  |                           | standard outputs: V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                  |                    |                    |                    |                    |                    |      |
|                  |                           | V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = –6 mA                                        | 2.40               | 2.82               | -                  | 2.20               | -                  | 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> = 1.2 V                                                                | -                  | 0                  | -                  | -                  | -                  |      |
|                  |                           | V <sub>CC</sub> = 2.0 V                                                                | -                  | 0                  | 0.2                | 1.8                | 0.2                | V    |
|                  |                           | V <sub>CC</sub> = 2.7 V                                                                | -                  | 0                  | 0.2                | 2.5                | 0.2                | V    |
|                  |                           | V <sub>CC</sub> = 3.0 V                                                                | -                  | 0                  | 0.2                | 2.8                | 0.2                | V    |
|                  |                           | V <sub>CC</sub> = 4.5 V                                                                | -                  | 0                  | 0.2                | 4.3                | 0.2                | V    |
|                  |                           | standard outputs: V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                  |                    |                    |                    |                    |                    |      |
|                  |                           | V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = 6 mA                                         | -                  | 0.25               | 0.40               | -                  | 0.50               | V    |
| I <sub>I</sub>   | input leakage current     | V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V                       | -                  | -                  | ±1                 | -                  | ±1                 | µA   |
|                  |                           |                                                                                        |                    |                    |                    |                    |                    |      |
| I <sub>CC</sub>  | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V | -                  | -                  | 20                 | -                  | 160                | µA   |
| ΔI <sub>CC</sub> | additional supply current | V <sub>I</sub> = V <sub>CC</sub> – 0.6 V; V <sub>CC</sub> = 2.7 V to 3.6 V             | -                  | -                  | 500                | -                  | 850                | µA   |
| C <sub>I</sub>   | input capacitance         |                                                                                        | -                  | 3.5                | -                  |                    |                    | pF   |

[1] Typical values are measured at T<sub>amb</sub> = 25 °C.

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

GND (ground = 0 V); for test circuit, see [Figure 12](#)

| Symbol   | Parameter         | Conditions                                                                                                             | –40 °C to +85 °C |                    |     | –40 °C to +125 °C |     | Unit |
|----------|-------------------|------------------------------------------------------------------------------------------------------------------------|------------------|--------------------|-----|-------------------|-----|------|
|          |                   |                                                                                                                        | Min              | Typ <sup>[1]</sup> | Max | Min               | Max |      |
| $t_{pd}$ | propagation delay | $\overline{CE}$ , CP to Q7, $\overline{Q7}$ ; see <a href="#">Figure 7</a> and <a href="#">Figure 8</a> <sup>[2]</sup> |                  |                    |     |                   |     |      |
|          |                   | $V_{CC} = 1.2\text{ V}$                                                                                                | -                | 115                | -   | -                 | -   | ns   |
|          |                   | $V_{CC} = 2.0\text{ V}$                                                                                                | -                | 38                 | 61  | -                 | 76  | ns   |
|          |                   | $V_{CC} = 2.7\text{ V}$                                                                                                | -                | 27                 | 43  | -                 | 54  | ns   |
|          |                   | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$ <sup>[3]</sup>                                                                 | -                | 22                 | 36  | -                 | 45  | ns   |
|          |                   | $V_{CC} = 3.3\text{ V}; C_L = 15\text{ pF}$                                                                            | -                | 18                 | -   | -                 | -   | ns   |
|          |                   | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ <sup>[4]</sup>                                                                 | -                | 15                 | 24  | -                 | 30  | ns   |
|          |                   | $\overline{PL}$ to Q7, $\overline{Q7}$ ; see <a href="#">Figure 8</a>                                                  |                  |                    |     |                   |     |      |
|          |                   | $V_{CC} = 1.2\text{ V}$                                                                                                | -                | 110                | -   | -                 | -   | ns   |
|          |                   | $V_{CC} = 2.0\text{ V}$                                                                                                | -                | 35                 | 56  | -                 | 70  | ns   |
|          |                   | $V_{CC} = 2.7\text{ V}$                                                                                                | -                | 24                 | 39  | -                 | 49  | ns   |
|          |                   | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$ <sup>[3]</sup>                                                                 | -                | 20                 | 33  | -                 | 41  | ns   |
|          |                   | $V_{CC} = 3.3\text{ V}; C_L = 15\text{ pF}$                                                                            | -                | 18                 | -   | -                 | -   | ns   |
|          |                   | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ <sup>[4]</sup>                                                                 | -                | 14                 | 22  | -                 | 27  | ns   |
|          |                   | D7 to Q7, $\overline{Q7}$ ; $C_L = 15\text{ pF}$ ; see <a href="#">Figure 9</a>                                        |                  |                    |     |                   |     |      |
|          |                   | $V_{CC} = 1.2\text{ V}$                                                                                                | -                | 90                 | -   | -                 | -   | ns   |
|          |                   | $V_{CC} = 2.0\text{ V}$                                                                                                | -                | 28                 | 45  | -                 | 56  | ns   |
|          |                   | $V_{CC} = 2.7\text{ V}$                                                                                                | -                | 20                 | 32  | -                 | 40  | ns   |
|          |                   | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$ <sup>[3]</sup>                                                                 | -                | 17                 | 27  | -                 | 33  | ns   |
|          |                   | $V_{CC} = 3.3\text{ V}; C_L = 15\text{ pF}$                                                                            | -                | 14                 | -   | -                 | -   | ns   |
|          |                   | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ <sup>[4]</sup>                                                                 | -                | 11                 | 18  | -                 | 22  | ns   |
| $t_W$    | pulse width       | CP input HIGH to LOW; see <a href="#">Figure 7</a>                                                                     |                  |                    |     |                   |     |      |
|          |                   | $V_{CC} = 2.0\text{ V}$                                                                                                | 34               | 10                 | -   | 41                | -   | ns   |
|          |                   | $V_{CC} = 2.7\text{ V}$                                                                                                | 25               | 8                  | -   | 30                | -   | ns   |
|          |                   | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$ <sup>[3]</sup>                                                                 | 20               | 7                  | -   | 24                | -   | ns   |
|          |                   | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ <sup>[4]</sup>                                                                 | 15               | 5                  | -   | 18                | -   | ns   |
|          |                   | $\overline{PL}$ input LOW; see <a href="#">Figure 8</a>                                                                |                  |                    |     |                   |     |      |
|          |                   | $V_{CC} = 2.0\text{ V}$                                                                                                | 34               | 10                 | -   | 41                | -   | ns   |
|          |                   | $V_{CC} = 2.7\text{ V}$                                                                                                | 25               | 8                  | -   | 30                | -   | ns   |
|          |                   | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$ <sup>[3]</sup>                                                                 | 20               | 7                  | -   | 24                | -   | ns   |
|          |                   | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ <sup>[4]</sup>                                                                 | 15               | 5                  | -   | 18                | -   | ns   |

**Table 7. Dynamic characteristics ...continued**GND (ground = 0 V); for test circuit, see [Figure 12](#)

| Symbol           | Parameter     | Conditions                                                                                                                       | –40 °C to +85 °C |                    |     | –40 °C to +125 °C |     | Unit |
|------------------|---------------|----------------------------------------------------------------------------------------------------------------------------------|------------------|--------------------|-----|-------------------|-----|------|
|                  |               |                                                                                                                                  | Min              | Typ <sup>[1]</sup> | Max | Min               | Max |      |
| t <sub>rec</sub> | recovery time | PL to CP, $\overline{\text{CE}}$ ; see <a href="#">Figure 8</a>                                                                  |                  |                    |     |                   |     |      |
|                  |               | V <sub>CC</sub> = 1.2 V                                                                                                          | -                | 40                 | -   | -                 | -   | ns   |
|                  |               | V <sub>CC</sub> = 2.0 V                                                                                                          | 24               | 15                 | -   | 30                | -   | ns   |
|                  |               | V <sub>CC</sub> = 2.7 V                                                                                                          | 18               | 11                 | -   | 23                | -   | ns   |
|                  |               | V <sub>CC</sub> = 3.0 V to 3.6 V <sup>[3]</sup>                                                                                  | 17               | 10                 | -   | 21                | -   | ns   |
|                  |               | V <sub>CC</sub> = 4.5 V to 5.5 V <sup>[4]</sup>                                                                                  | 12               | 7                  | -   | 15                | -   | ns   |
| t <sub>su</sub>  | set-up time   | DS to CP, $\overline{\text{CE}}$ ; see <a href="#">Figure 10</a>                                                                 |                  |                    |     |                   |     |      |
|                  |               | V <sub>CC</sub> = 1.2 V                                                                                                          | -                | –8                 | -   | -                 | -   | ns   |
|                  |               | V <sub>CC</sub> = 2.0 V                                                                                                          | 22               | –2                 | -   | 26                | -   | ns   |
|                  |               | V <sub>CC</sub> = 2.7 V                                                                                                          | 16               | –1                 | -   | 19                | -   | ns   |
|                  |               | V <sub>CC</sub> = 3.0 V to 3.6 V <sup>[3]</sup>                                                                                  | 13               | –1                 | -   | 15                | -   | ns   |
|                  |               | V <sub>CC</sub> = 4.5 V to 5.5 V <sup>[4]</sup>                                                                                  | 9                | 0                  | -   | 10                | -   | ns   |
|                  |               | $\overline{\text{CE}}$ to CP, CP to $\overline{\text{CE}}$ ;<br>see <a href="#">Figure 10</a>                                    |                  |                    |     |                   |     |      |
|                  |               | V <sub>CC</sub> = 1.2 V                                                                                                          | -                | 20                 | -   | -                 | -   | ns   |
|                  |               | V <sub>CC</sub> = 2.0 V                                                                                                          | 22               | 7                  | -   | 26                | -   | ns   |
|                  |               | V <sub>CC</sub> = 2.7 V                                                                                                          | 16               | 5                  | -   | 19                | -   | ns   |
|                  |               | V <sub>CC</sub> = 3.0 V to 3.6 V <sup>[3]</sup>                                                                                  | 13               | 4                  | -   | 15                | -   | ns   |
|                  |               | V <sub>CC</sub> = 4.5 V to 5.5 V <sup>[4]</sup>                                                                                  | 9                | 3                  | -   | 10                | -   | ns   |
|                  |               | Dn to PL;<br>see <a href="#">Figure 11</a>                                                                                       |                  |                    |     |                   |     |      |
|                  |               | V <sub>CC</sub> = 1.2 V                                                                                                          | -                | 25                 | -   | -                 | -   | ns   |
|                  |               | V <sub>CC</sub> = 2.0 V                                                                                                          | 22               | 8                  | -   | 26                | -   | ns   |
|                  |               | V <sub>CC</sub> = 2.7 V                                                                                                          | 16               | 6                  | -   | 19                | -   | ns   |
|                  |               | V <sub>CC</sub> = 3.0 V to 3.6 V <sup>[3]</sup>                                                                                  | 13               | 5                  | -   | 15                | -   | ns   |
|                  |               | V <sub>CC</sub> = 4.5 V to 5.5 V <sup>[4]</sup>                                                                                  | 9                | 4                  | -   | 10                | -   | ns   |
| t <sub>h</sub>   | hold time     | DS to CP, $\overline{\text{CE}}$ ; Dn to $\overline{\text{PL}}$ ;<br>see <a href="#">Figure 10</a> and <a href="#">Figure 11</a> |                  |                    |     |                   |     |      |
|                  |               | V <sub>CC</sub> = 1.2 V                                                                                                          | -                | 20                 | -   | -                 | -   | ns   |
|                  |               | V <sub>CC</sub> = 2.0 V                                                                                                          | 22               | 7                  | -   | 26                | -   | ns   |
|                  |               | V <sub>CC</sub> = 2.7 V                                                                                                          | 16               | 5                  | -   | 19                | -   | ns   |
|                  |               | V <sub>CC</sub> = 3.0 V to 3.6 V <sup>[3]</sup>                                                                                  | 13               | 4                  | -   | 15                | -   | ns   |
|                  |               | V <sub>CC</sub> = 4.5 V to 5.5 V <sup>[4]</sup>                                                                                  | 9                | 3                  | -   | 10                | -   | ns   |
|                  |               | $\overline{\text{CE}}$ to CP, CP to $\overline{\text{CE}}$ ;<br>see <a href="#">Figure 10</a>                                    |                  |                    |     |                   |     |      |
|                  |               | V <sub>CC</sub> = 1.2 V                                                                                                          | -                | –30                | -   | -                 | -   | ns   |
|                  |               | V <sub>CC</sub> = 2.0 V                                                                                                          | 5                | –8                 | -   | 5                 | -   | ns   |
|                  |               | V <sub>CC</sub> = 2.7 V                                                                                                          | 5                | –6                 | -   | 5                 | -   | ns   |
|                  |               | V <sub>CC</sub> = 3.0 V to 3.6 V <sup>[3]</sup>                                                                                  | 5                | –5                 | -   | 5                 | -   | ns   |
|                  |               | V <sub>CC</sub> = 4.5 V to 5.5 V <sup>[4]</sup>                                                                                  | 5                | –4                 | -   | 5                 | -   | ns   |

**Table 7. Dynamic characteristics ...continued**  
 GND (ground = 0 V); for test circuit, see [Figure 12](#)

| Symbol     | Parameter                     | Conditions                                                           | –40 °C to +85 °C |                    |     | –40 °C to +125 °C |     | Unit |
|------------|-------------------------------|----------------------------------------------------------------------|------------------|--------------------|-----|-------------------|-----|------|
|            |                               |                                                                      | Min              | Typ <sup>[1]</sup> | Max | Min               | Max |      |
| $f_{\max}$ | maximum frequency             | see <a href="#">Figure 7</a>                                         |                  |                    |     |                   |     |      |
|            |                               | $V_{CC} = 2.0 \text{ V}$                                             | 14               | 40                 | -   | 12                | -   | MHz  |
|            |                               | $V_{CC} = 2.7 \text{ V}$                                             | 19               | 60                 | -   | 16                | -   | MHz  |
|            |                               | $V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$ <sup>[3]</sup>            | 24               | 65                 | -   | 20                | -   | MHz  |
|            |                               | $V_{CC} = 3.3 \text{ V}; C_L = 15 \text{ pF}$                        | -                | 78                 | -   | -                 | -   | MHz  |
|            |                               | $V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$ <sup>[4]</sup>            | 36               | 75                 | -   | 30                | -   | MHz  |
| $C_{PD}$   | power dissipation capacitance | $V_I = \text{GND to } V_{CC}; V_{CC} = 3.3 \text{ V}$ <sup>[5]</sup> | -                | 35                 | -   |                   |     | pF   |

[1] Typical values are measured at  $T_{\text{amb}} = 25 \text{ °C}$ .

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

[3] Typical values are measured at  $V_{CC} = 3.3 \text{ V}$ .

[4] Typical values are measured at  $V_{CC} = 5.0 \text{ V}$ .

[5]  $C_{PD}$  is used to determine the dynamic power dissipation  $P_D = C_{PD} \times V_{CC}^2 \times f_i + \Sigma (C_L \times V_{CC}^2 \times f_o)$  ( $P_D$  in  $\mu\text{W}$ ), where:

$f_i$  = input frequency in MHz;

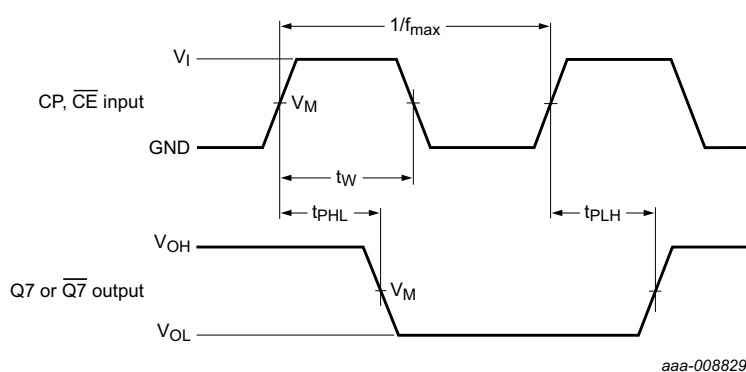
$f_o$  = output frequency in MHz;

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

$C_L$  = output load capacitance in pF;

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

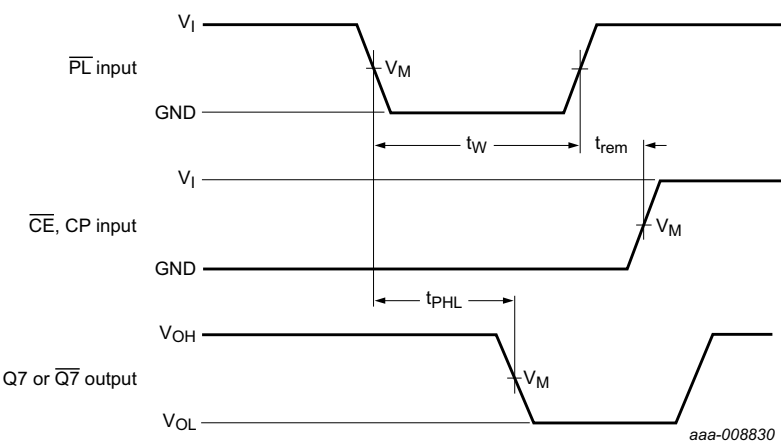
## 11. Waveforms



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

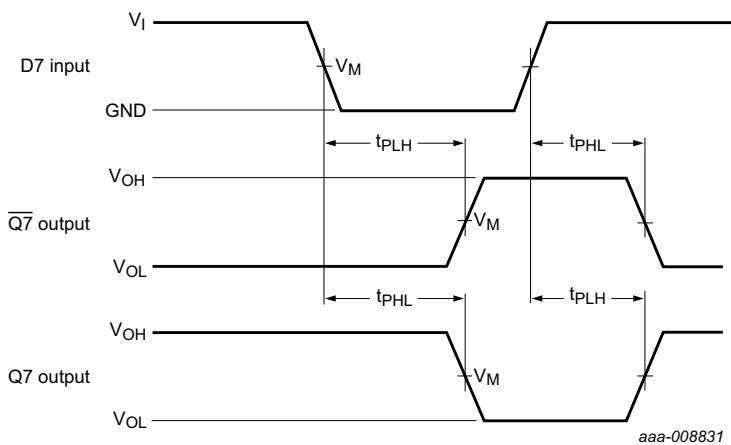
The changing to output assumes that internal Q6 is opposite state from Q7.

**Fig 7. Clock pulse (CP) and clock enable ( $\overline{\text{CE}}$ ) to output (Q7 or  $\overline{\text{Q7}}$ ) propagation delays, clock pulse width and maximum clock frequency**



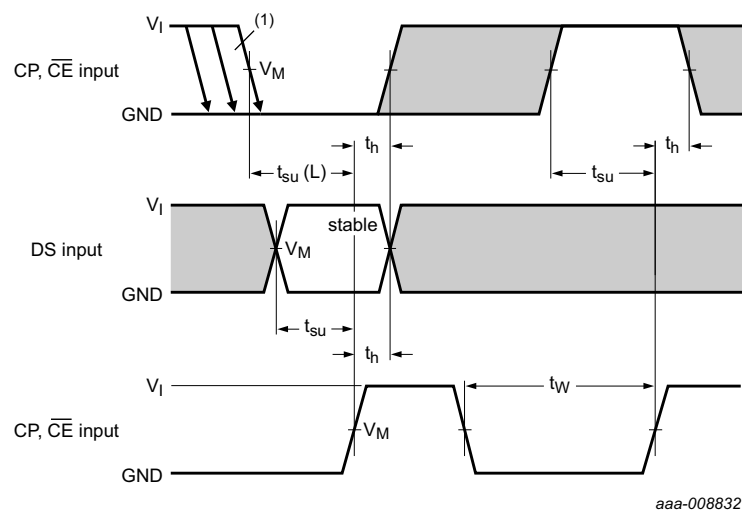
Measurement points are given in [Table 8](#).  
The changing to output assumes that internal Q6 is opposite state from Q7.

**Fig 8.** Parallel load ( $\overline{PL}$ ) pulse width, parallel load to output (Q7 or  $\overline{Q7}$ ) propagation delays, parallel load to clock (CP) and clock enable ( $\overline{CE}$ ) recovery time



Measurement points are given in [Table 8](#).  
The changing to output assumes that internal Q6 is opposite state from Q7.

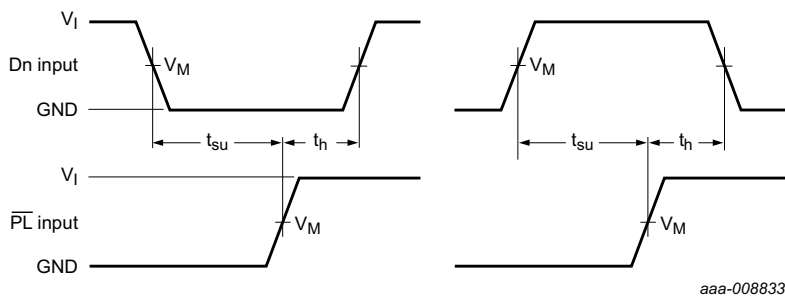
**Fig 9.** Data input (Dn) to output (Q7 or  $\overline{Q7}$ ) propagation delays when  $\overline{PL}$  is LOW



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

- (1) 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.

Fig 10. Set-up and hold times

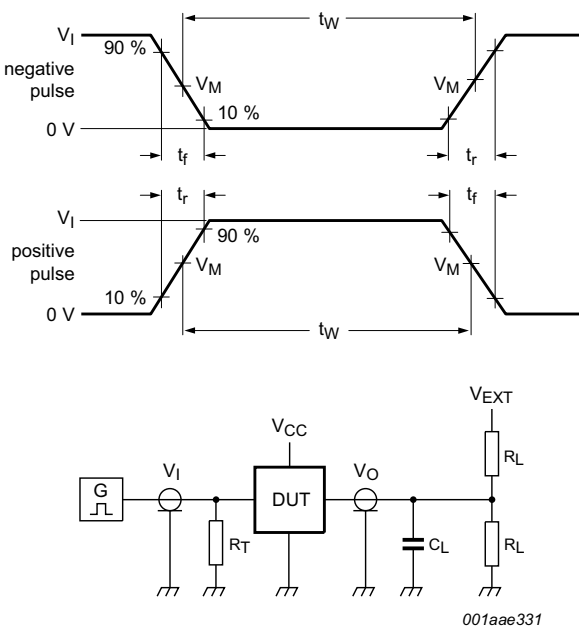


Measurement points are given in [Table 8](#).

Fig 11. Set-up and hold times from the data inputs (Dn) to the parallel load input ( $\overline{PL}$ )

Table 8. Measurement points

| Supply voltage | Input       | Output      |
|----------------|-------------|-------------|
| $V_{CC}$       | $V_M$       | $V_M$       |
| < 2.7 V        | $0.5V_{CC}$ | $0.5V_{CC}$ |
| 2.7 V to 3.6 V | 1.5 V       | 1.5 V       |
| $\geq 4.5$ V   | $0.5V_{CC}$ | $0.5V_{CC}$ |



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.  
 $V_{EXT}$  = External voltage for measuring switching times.

Fig 12. Test circuit for measuring switching times

Table 9. Test data

| Supply voltage | Input    |            | Load         |              | $V_{EXT}$          |
|----------------|----------|------------|--------------|--------------|--------------------|
|                | $V_I$    | $t_r, t_f$ | $C_L$        | $R_L$        | $t_{PHL}, t_{PLH}$ |
| < 2.7 V        | $V_{CC}$ | 2.5 ns     | 50 pF        | 1 k $\Omega$ | open               |
| 2.7 V to 3.6 V | 2.7 V    | 2.5 ns     | 50 pF, 15 pF | 1 k $\Omega$ | open               |
| $\geq 4.5$ V   | $V_{CC}$ | 2.5 ns     | 50 pF        | 1 k $\Omega$ | open               |

12. Package outline

DIP16: plastic dual in-line package; 16 leads (300 mil)

SOT38-4

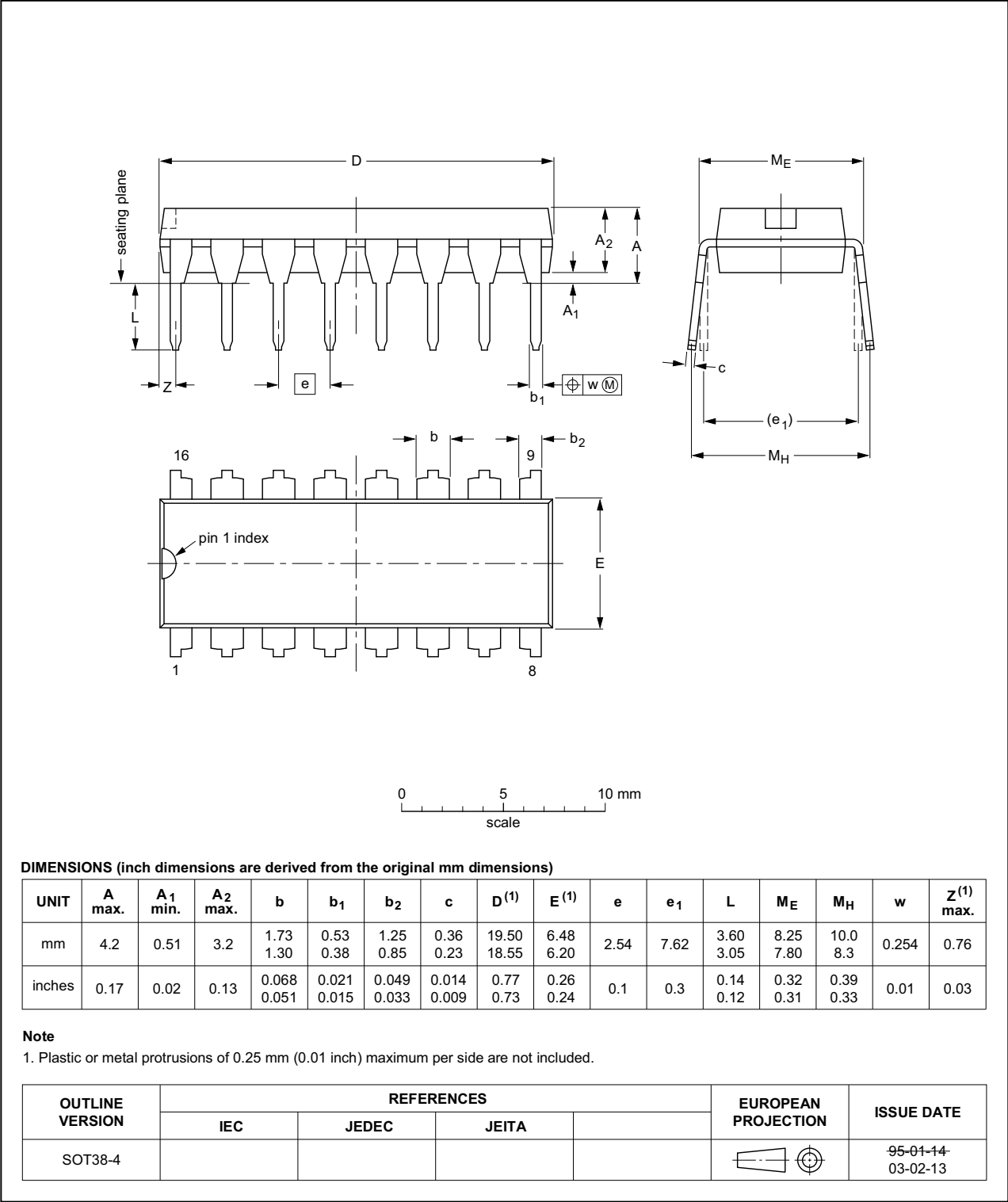


Fig 13. Package outline SOT38-4 (DIP16)

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

SOT109-1

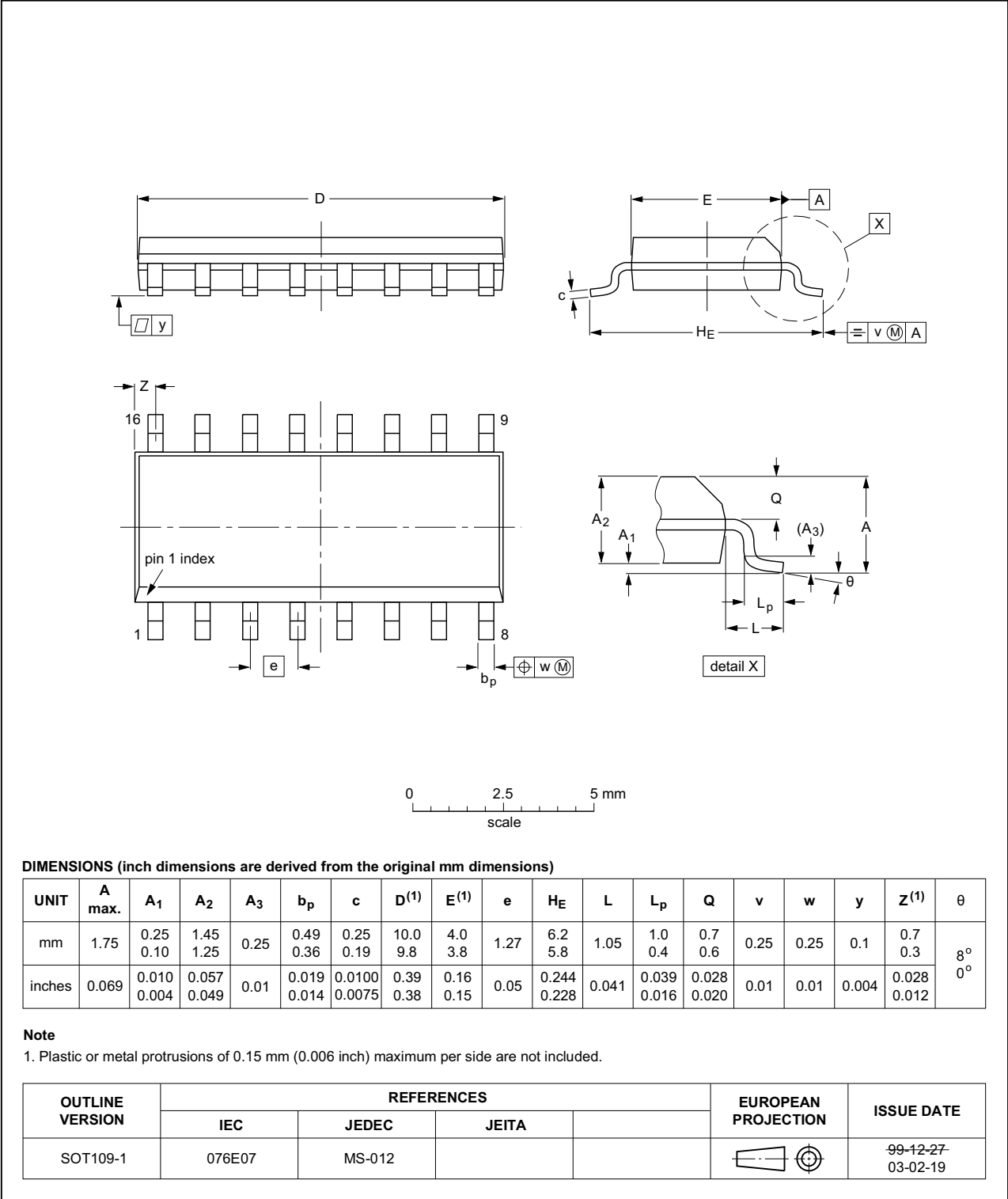


Fig 14. Package outline SOT109-1 (SO16)

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

SOT338-1

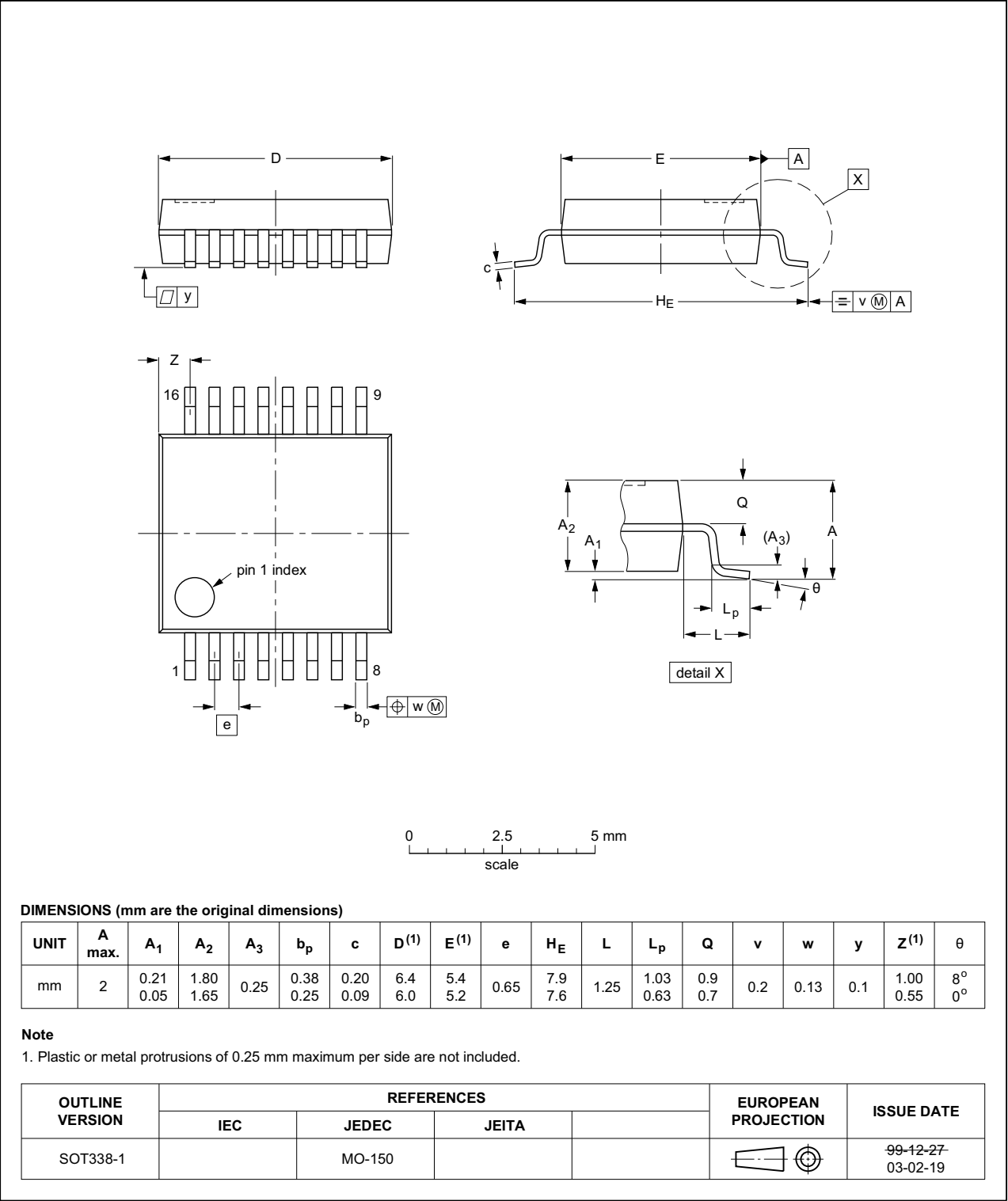


Fig 15. Package outline SOT338-1 (SSOP16)

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

SOT403-1

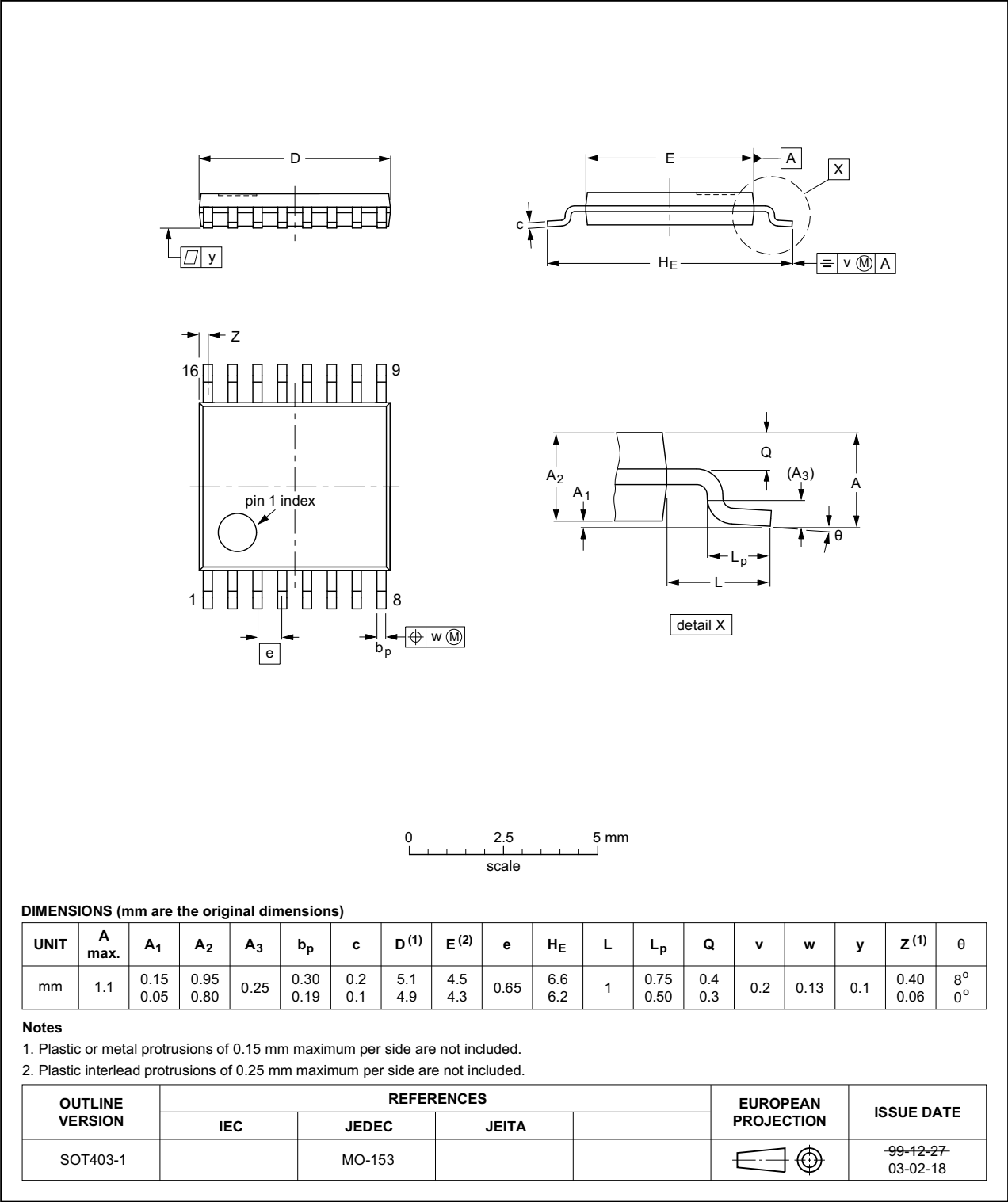


Fig 16. Package outline SOT403-1 (TSSOP16)

## 13. Abbreviations

Table 10. Abbreviations

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

## 14. Revision history

Table 11. Revision history

| Document ID    | Release date                                                                                                                                                                                                                                                                                                                           | Data sheet status     | Change notice | Supersedes    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|---------------|
| 74LV165 v.6    | 20140219                                                                                                                                                                                                                                                                                                                               | Product data sheet    | -             | 74LV165 v.5   |
| Modifications: | <ul style="list-style-type: none"><li>Typo corrected in <a href="#">Table 2 "Pin description"</a></li></ul>                                                                                                                                                                                                                            |                       |               |               |
| 74LV165 v.5    | 20130909                                                                                                                                                                                                                                                                                                                               | Product data sheet    | -             | 74LV165 v.4   |
| Modifications: | <ul style="list-style-type: none"><li>Typo corrected in the header of <a href="#">Table 6 "Static characteristics"</a></li></ul>                                                                                                                                                                                                       |                       |               |               |
| 74LV165 v.4    | 20130830                                                                                                                                                                                                                                                                                                                               | Product data sheet    | -             | 74LV165_CNV_3 |
| Modifications: | <ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li><li>Legal texts have been adapted to the new company name where appropriate.</li><li>Family data added, see <a href="#">Section 9 "Static characteristics"</a></li></ul> |                       |               |               |
| 74LV165_CNV_3  | December 1998                                                                                                                                                                                                                                                                                                                          | Product specification | -             | -             |

## 15. Legal information

### 15.1 Data sheet status

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

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

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