

74LV165-Q100

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

Rev. 2 — 24 February 2014

Product data sheet

1. General description

The 74LV165-Q100 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.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
 - ◆ Specified from $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ and from $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$
- 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:
 - ◆ MIL-STD-883C, method 3015 exceeds 2000 V
 - ◆ HBM JESD22-A114F exceeds 2000 V
 - ◆ MM JESD22-A115-A exceeds 200 V (C = 200 pF, R = 0 Ω)

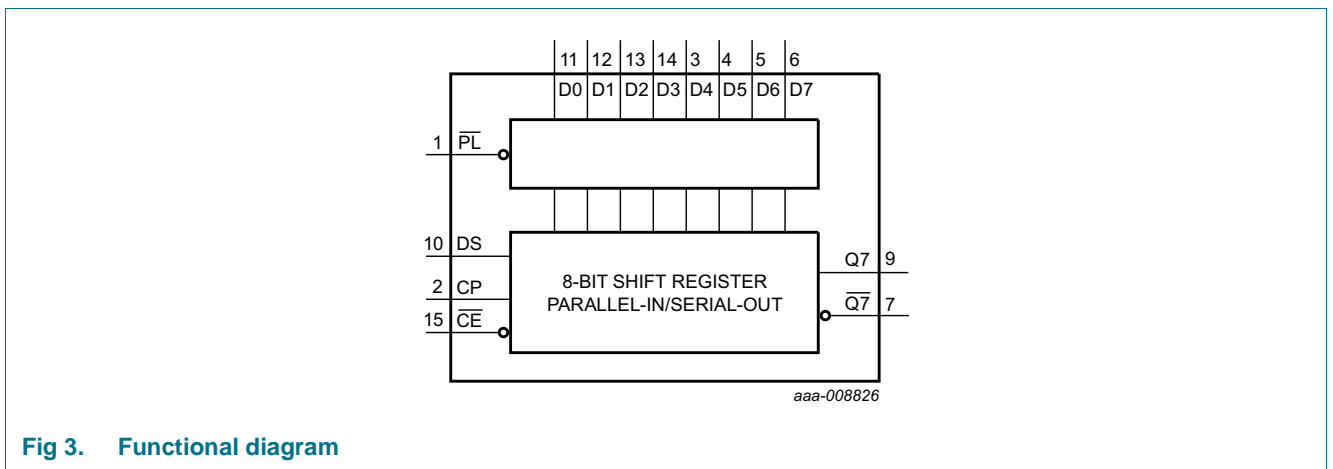
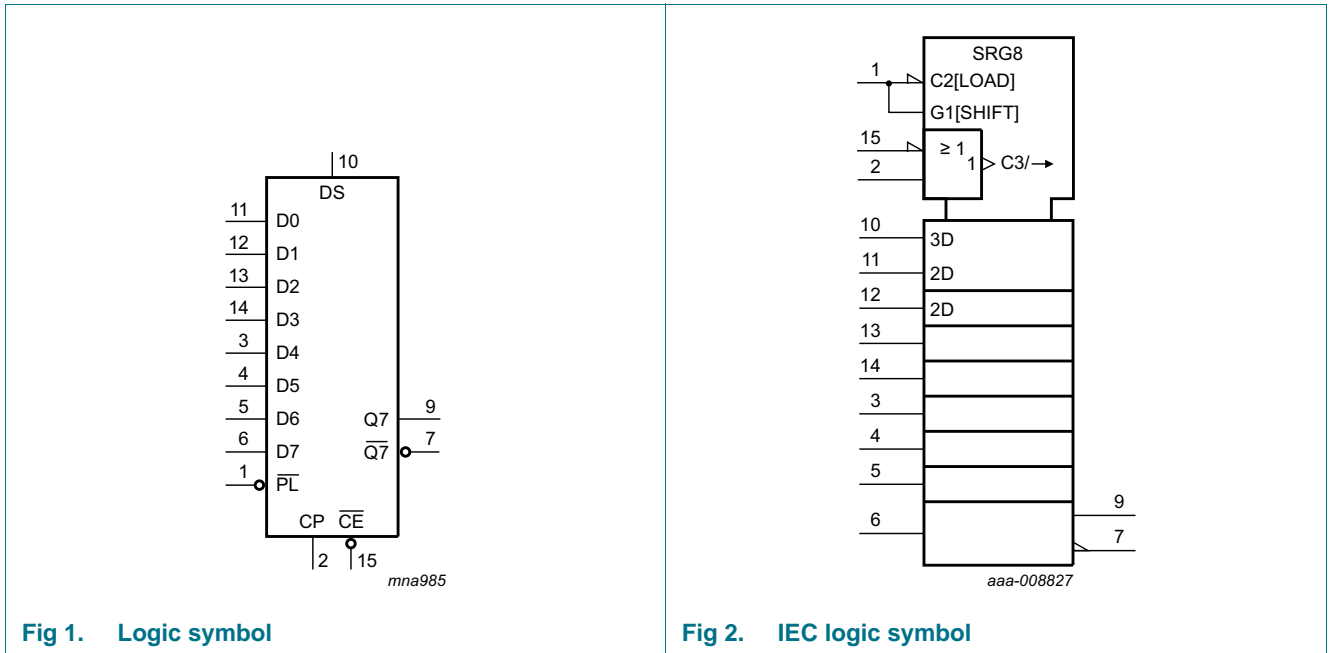


3. Ordering information

Table 1. Ordering information

| Type number | Package | | | Version |
|----------------|-------------------|---------|--|----------|
| | Temperature range | Name | Description | |
| 74LV165D-Q100 | -40 °C to +125 °C | SO16 | plastic small outline package; 16 leads; body width 3.9 mm | SOT109-1 |
| 74LV165PW-Q100 | -40 °C to +125 °C | TSSOP16 | plastic thin shrink small outline package; 16 leads; body width 4.4 mm | SOT403-1 |

4. Functional diagram



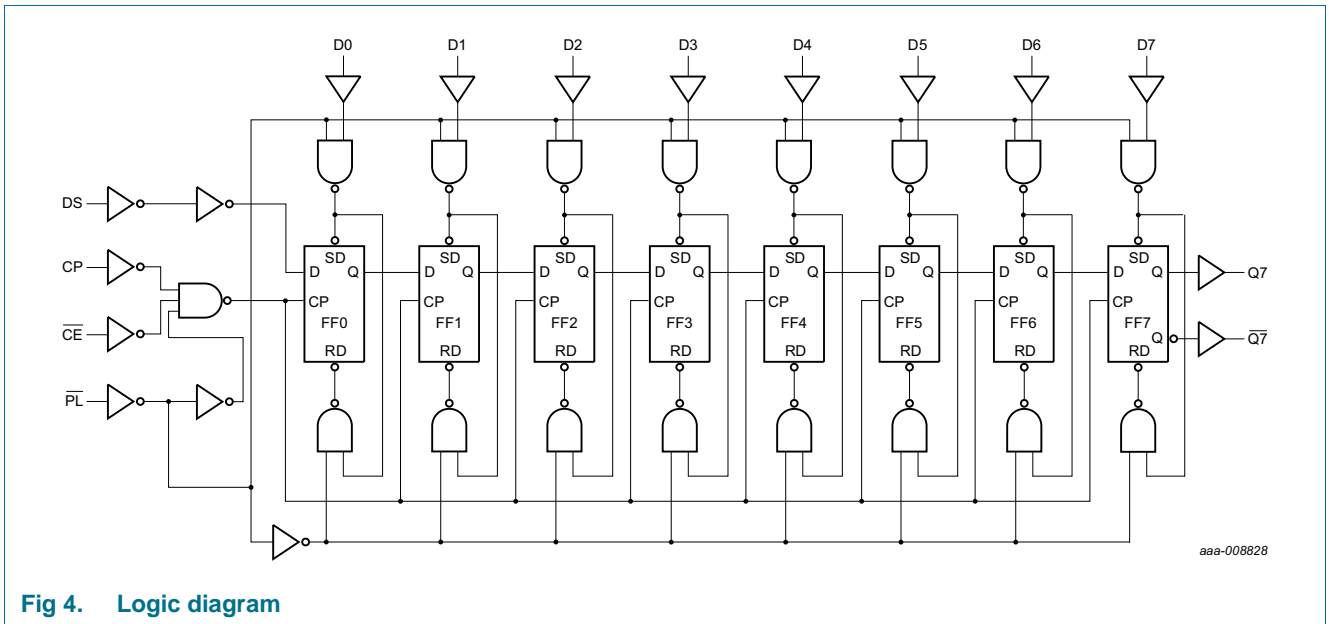


Fig 4. Logic diagram

5. Pinning information

5.1 Pinning

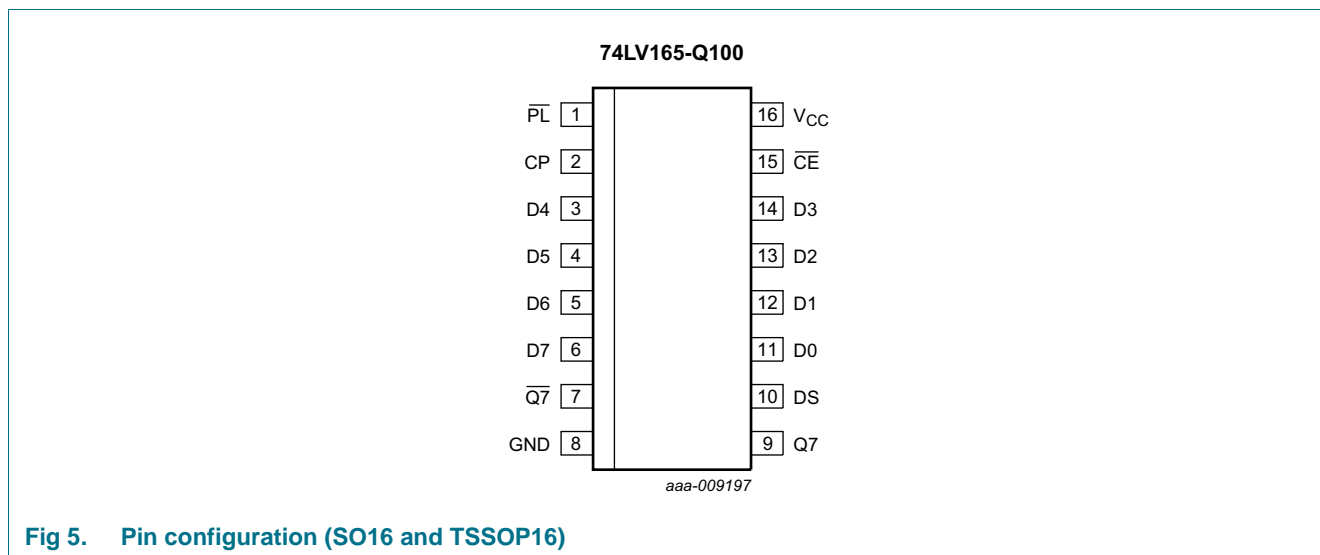


Fig 5. Pin configuration (SO16 and TSSOP16)

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^[1]

| Operating modes | Inputs | | | | | Qn registers | | Output | |
|-------------------|--------|----|----|----|----------|--------------|----------|--------|----|
| | PL | CE | CP | DS | D0 to D7 | Q0 | Q1 to Q6 | Q7 | 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 | q6 |
| | H | L | ↑ | h | X | H | q0 to q5 | q6 | 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.

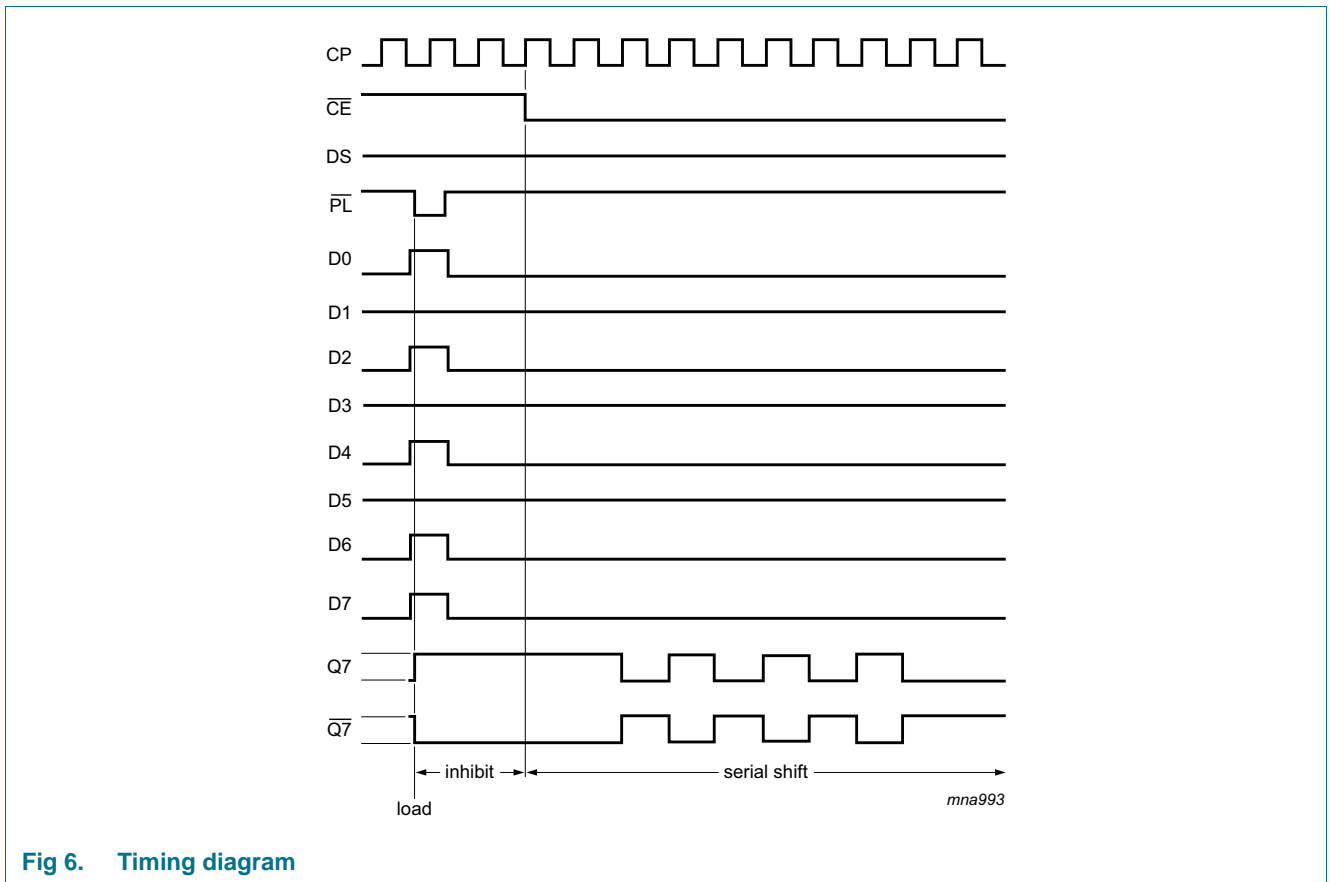


Fig 6. Timing diagram

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)^[1]

| Symbol | Parameter | Conditions | Min | Max | Unit |
|------------------|-------------------------|---|------------------|------|------|
| V _{CC} | supply voltage | | -0.5 | +7 | V |
| I _{IK} | input clamping current | V _I < -0.5 V or V _I > V _{CC} + 0.5 V | - | 20 | mA |
| V _I | input voltage | | -0.5 | +7 | V |
| I _{OK} | output clamping current | V _O > V _{CC} or V _O < 0 | - | ±50 | mA |
| I _O | output current | -0.5 V < V _O < V _{CC} + 0.5 V | - | ±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 °C to +125 °C | | | |
| | | SO16 package | ^[2] - | 500 | mW |
| | | TSSOP16 package | ^[3] - | 400 | mW |

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

[2] P_{tot} derates linearly with 8 mW/K above 70 °C.

[3] P_{tot} 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 _{CC} | supply voltage | | 1.0 | 3.3 | 5.5 | V |
| V _I | input voltage | | 0 | - | V _{CC} | V |
| V _O | output voltage | | 0 | - | V _{CC} | V |
| T _{amb} | ambient temperature | | -40 | - | +85 | °C |
| Δt/ΔV | input transition rise and fall rate | V _{CC} = 1.0 V to 2.0 V | 0 | - | 500 | ns/V |
| | | V _{CC} = 2.0 V to 2.7 V | 0 | - | 200 | ns/V |
| | | V _{CC} = 2.7 V to 3.6 V | 0 | - | 100 | ns/V |
| | | V _{CC} = 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 ^[1] | Max | Min | Max | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 1.2 V | 0.9 | - | - | 0.9 | - | V | |
| | | V _{CC} = 2.3 V to 2.7 V | 1.4 | - | - | 1.4 | - | V | |
| | | V _{CC} = 2.7 V to 3.6 V | 2.0 | - | - | 2.0 | - | V | |
| | | V _{CC} = 4.5 V to 5.5 V | 0.7V _{CC} | - | - | 0.7V _{CC} | - | V | |
| V _{IL} | LOW-level input voltage | V _{CC} = 1.2 V | - | - | 0.3 | - | 0.3 | V | |
| | | V _{CC} = 2.3 V to 2.7 V | - | - | 0.6 | - | 0.6 | V | |
| | | V _{CC} = 2.7 V to 3.6 V | - | - | 0.8 | - | 0.8 | V | |
| | | V _{CC} = 4.5 V to 5.5 V | - | - | 0.3V _{CC} | - | 0.3V _{CC} | | |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} ; I _O = -100 μA | | | | | | | |
| | | V _{CC} = 1.2 V | - | 1.2 | - | - | - | | |
| | | V _{CC} = 2.0 V | 1.8 | 2.0 | - | 1.8 | - | V | |
| | | V _{CC} = 2.7 V | 2.5 | 2.7 | - | 2.5 | - | V | |
| | | V _{CC} = 3.0 V | 2.8 | 3.0 | - | 2.8 | - | V | |
| | | V _{CC} = 4.5 V | 4.3 | 4.5 | - | 4.3 | - | V | |
| | | standard outputs: V _I = V _{IH} or V _{IL} | | | | | | | |
| | | V _{CC} = 3.0 V; I _O = -6 mA | 2.40 | 2.82 | - | 2.20 | - | V | |
| V _{CC} = 4.5 V; I _O = -12 mA | 3.60 | 4.20 | - | 3.50 | - | V | | | |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} ; I _O = 100 μA | | | | | | | |
| | | V _{CC} = 1.2 V | - | 0 | - | - | - | | |
| | | V _{CC} = 2.0 V | - | 0 | 0.2 | 1.8 | 0.2 | V | |
| | | V _{CC} = 2.7 V | - | 0 | 0.2 | 2.5 | 0.2 | V | |
| | | V _{CC} = 3.0 V | - | 0 | 0.2 | 2.8 | 0.2 | V | |
| | | V _{CC} = 4.5 V | - | 0 | 0.2 | 4.3 | 0.2 | V | |
| | | standard outputs: V _I = V _{IH} or V _{IL} | | | | | | | |
| | | V _{CC} = 3.0 V; I _O = 6 mA | - | 0.25 | 0.40 | - | 0.50 | V | |
| V _{CC} = 4.5 V; I _O = 12 mA | - | 0.35 | 0.55 | - | 0.65 | V | | | |
| I _I | input leakage current | V _I = V _{CC} or GND; V _{CC} = 5.5 V | - | - | ±1 | - | ±1 | μA | |
| I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V | - | - | 20 | - | 160 | μA | |
| ΔI _{CC} | additional supply current | V _I = V _{CC} - 0.6 V; V _{CC} = 2.7 V to 3.6 V | - | - | 500 | - | 850 | μA | |
| C _I | input capacitance | | - | 3.5 | - | | | pF | |

[1] Typical values are measured at T_{amb} = 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 ^[1] | Max | Min | Max | | |
| t _{pd} | propagation delay | \overline{CE} , CP to Q7, $\overline{Q7}$; see Figure 7 and Figure 8 | | [2] | | | | | |
| | | V _{CC} = 1.2 V | - | 115 | - | - | - | ns | |
| | | V _{CC} = 2.0 V | - | 38 | 61 | - | 76 | ns | |
| | | V _{CC} = 2.7 V | - | 27 | 43 | - | 54 | ns | |
| | | V _{CC} = 3.0 V to 3.6 V | [3] | 22 | 36 | - | 45 | ns | |
| | | V _{CC} = 3.3 V; C _L = 15 pF | | 18 | - | - | - | ns | |
| | | V _{CC} = 4.5 V to 5.5 V | [4] | 15 | 24 | - | 30 | ns | |
| | | \overline{PL} to Q7, $\overline{Q7}$; see Figure 8 | | | | | | | |
| | | V _{CC} = 1.2 V | - | 110 | - | - | - | ns | |
| | | V _{CC} = 2.0 V | - | 35 | 56 | - | 70 | ns | |
| | | V _{CC} = 2.7 V | - | 24 | 39 | - | 49 | ns | |
| | | V _{CC} = 3.0 V to 3.6 V | [3] | 20 | 33 | - | 41 | ns | |
| | | V _{CC} = 3.3 V; C _L = 15 pF | | 18 | - | - | - | ns | |
| | | V _{CC} = 4.5 V to 5.5 V | [4] | 14 | 22 | - | 27 | ns | |
| | | D7 to Q7, $\overline{Q7}$; C _L = 15 pF; see Figure 9 | | | | | | | |
| | | V _{CC} = 1.2 V | - | 90 | - | - | - | ns | |
| | | V _{CC} = 2.0 V | - | 28 | 45 | - | 56 | ns | |
| | | V _{CC} = 2.7 V | - | 20 | 32 | - | 40 | ns | |
| | | V _{CC} = 3.0 V to 3.6 V | [3] | 17 | 27 | - | 33 | ns | |
| V _{CC} = 3.3 V; C _L = 15 pF | | 14 | - | - | - | ns | | | |
| V _{CC} = 4.5 V to 5.5 V | [4] | 11 | 18 | - | 22 | ns | | | |
| t _w | pulse width | CP input HIGH to LOW; see Figure 7 | | | | | | | |
| | | V _{CC} = 2.0 V | 34 | 10 | - | 41 | - | ns | |
| | | V _{CC} = 2.7 V | 25 | 8 | - | 30 | - | ns | |
| | | V _{CC} = 3.0 V to 3.6 V | [3] | 20 | 7 | - | 24 | - | ns |
| | | V _{CC} = 4.5 V to 5.5 V | [4] | 15 | 5 | - | 18 | - | ns |
| | | \overline{PL} input LOW; see Figure 8 | | | | | | | |
| | | V _{CC} = 2.0 V | 34 | 10 | - | 41 | - | ns | |
| | | V _{CC} = 2.7 V | 25 | 8 | - | 30 | - | ns | |
| | | V _{CC} = 3.0 V to 3.6 V | [3] | 20 | 7 | - | 24 | - | ns |
| | | V _{CC} = 4.5 V to 5.5 V | [4] | 15 | 5 | - | 18 | - | ns |

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

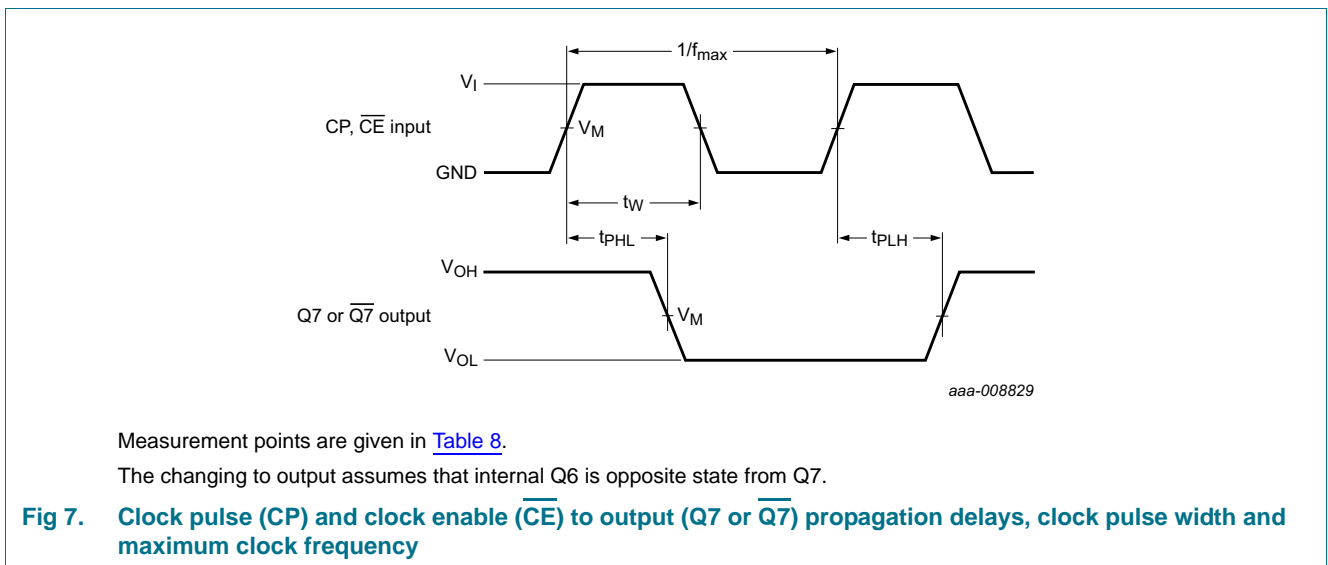
| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | -40 °C to +125 °C | | Unit | | |
|---|---------------|---|------------------|--|-----|-------------------|-----|------|---|----|
| | | | Min | Typ ^[1] | Max | Min | Max | | | |
| t _{rec} | recovery time | \overline{PL} to CP, \overline{CE}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

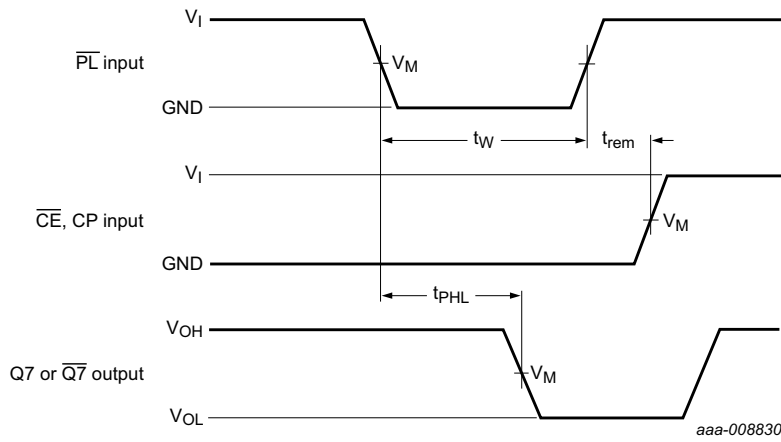
Table 7. Dynamic characteristics ...continued
 GND (ground = 0 V); for test circuit, see [Figure 12](#)

| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | -40 °C to +125 °C | | Unit |
|------------------|-------------------------------|--|------------------|--------------------|-----|-------------------|-----|------|
| | | | Min | Typ ^[1] | Max | Min | Max | |
| f _{max} | maximum frequency | see Figure 7 | | | | | | |
| | | V _{CC} = 2.0 V | 14 | 40 | - | 12 | - | MHz |
| | | V _{CC} = 2.7 V | 19 | 60 | - | 16 | - | MHz |
| | | V _{CC} = 3.0 V to 3.6 V ^[3] | 24 | 65 | - | 20 | - | MHz |
| | | V _{CC} = 3.3 V; C _L = 15 pF | - | 78 | - | - | - | MHz |
| | | V _{CC} = 4.5 V to 5.5 V ^[4] | 36 | 75 | - | 30 | - | MHz |
| C _{PD} | power dissipation capacitance | V _I = GND to V _{CC} ; V _{CC} = 3.3 V ^[5] | - | 35 | - | | | pF |

- [1] Typical values are measured at T_{amb} = 25 °C.
- [2] t_{pd} is the same as t_{PHL} and t_{PLH}.
- [3] Typical values are measured at V_{CC} = 3.3 V.
- [4] Typical values are measured at V_{CC} = 5.0 V.
- [5] C_{PD} is used to determine the dynamic power dissipation P_D = C_{PD} × V_{CC}² × f_i + Σ (C_L × V_{CC}² × f_o) (P_D in μW), where:
 f_i = input frequency in MHz;
 f_o = output frequency in MHz;
 Σ (C_L × V_{CC}² × f_o) = sum of outputs;
 C_L = output load capacitance in pF;
 V_{CC} = supply voltage in V.

11. Waveforms

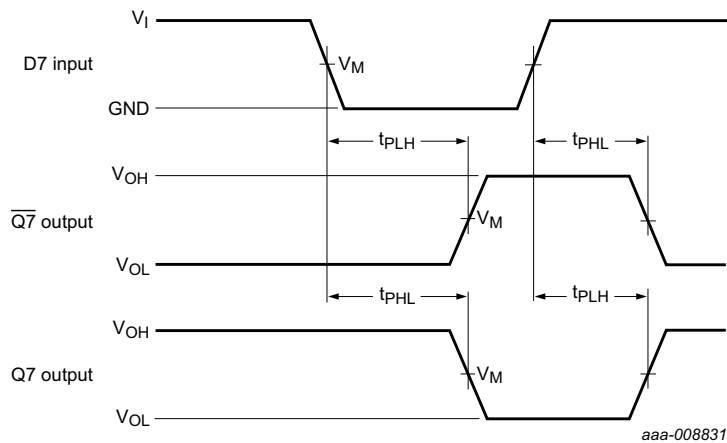




Measurement points are given in [Table 8](#).

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

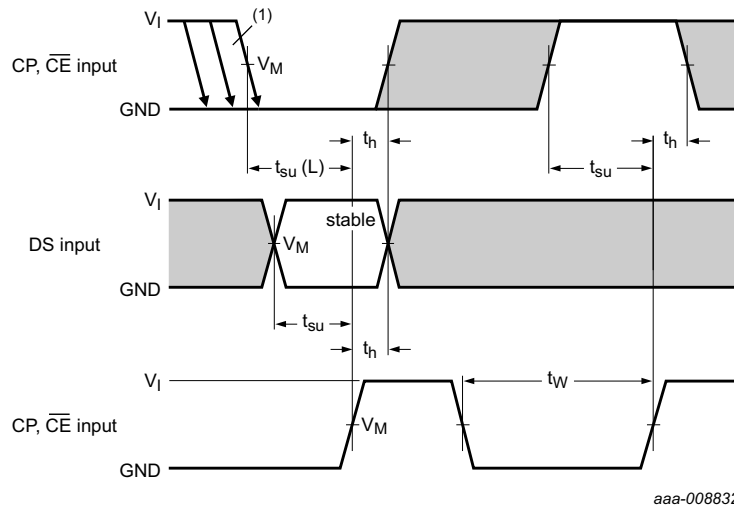
Fig 8. Parallel load (\overline{PL}) pulse width, parallel load to output (Q7 or $\overline{Q7}$) propagation delays, parallel load to clock (CP) and clock enable (\overline{CE}) recovery time



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

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

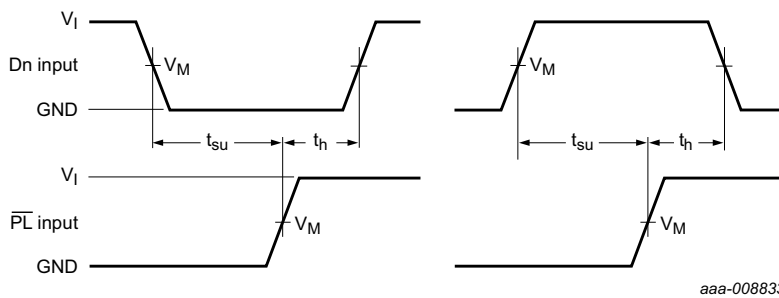
Fig 9. Data input (Dn) to output (Q7 or $\overline{Q7}$) propagation delays when \overline{PL} is LOW



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

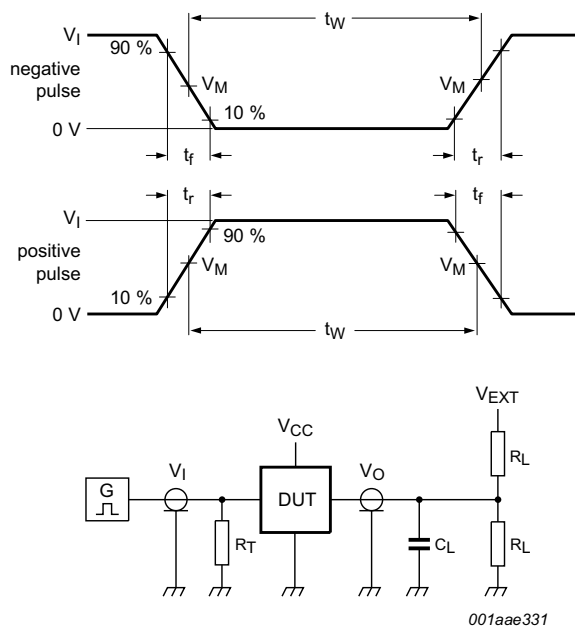


Measurement points are given in [Table 8](#).

Fig 11. Set-up and hold times from the data inputs (Dn) to the parallel load input (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 |
| ≥ 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 Ω | open |
| 2.7 V to 3.6 V | 2.7 V | 2.5 ns | 50 pF, 15 pF | 1 k Ω | open |
| \geq 4.5 V | V_{CC} | 2.5 ns | 50 pF | 1 k Ω | open |

12. Package outline

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

SOT109-1

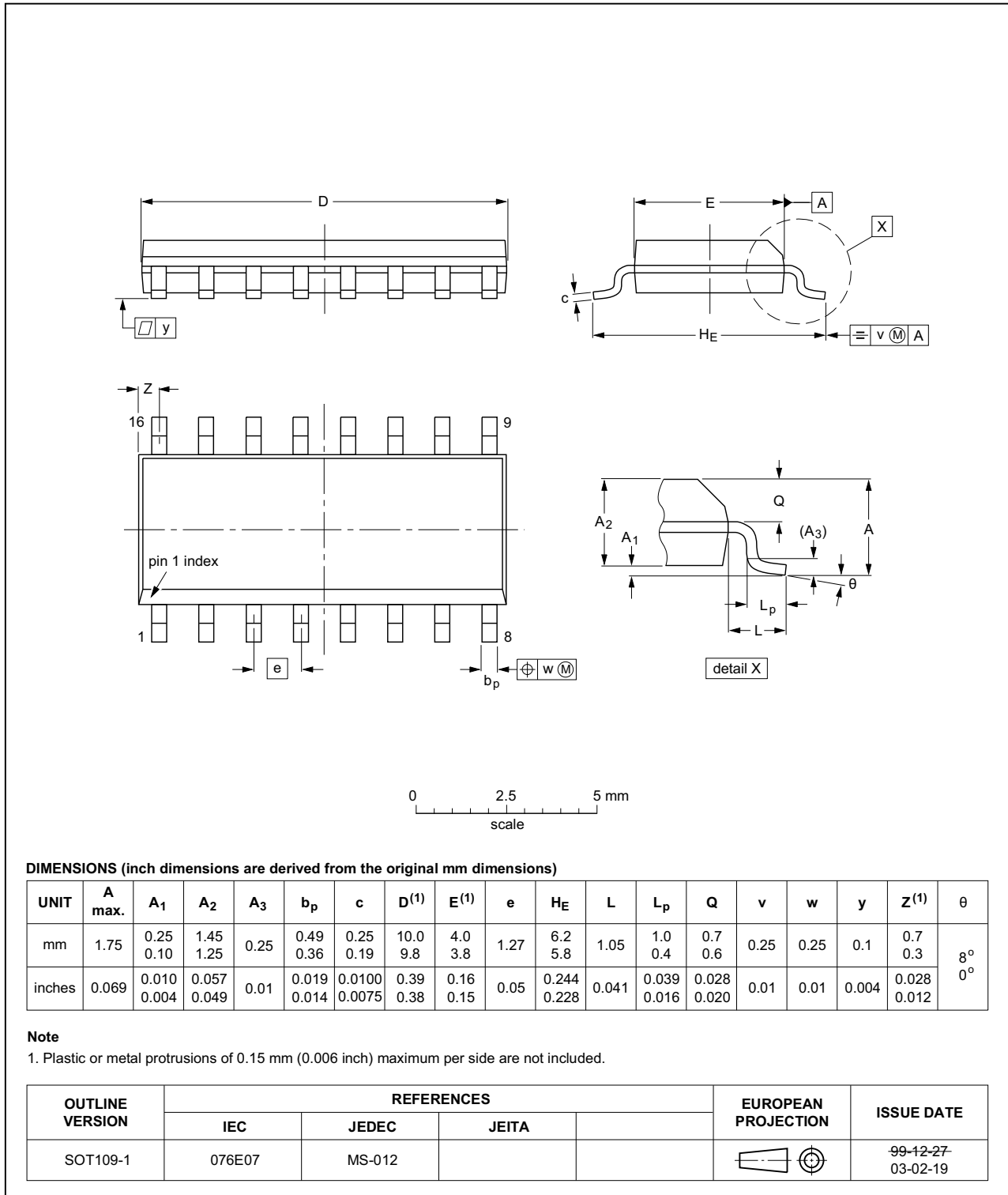


Fig 13. Package outline SOT109-1 (SO16)

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

SOT403-1

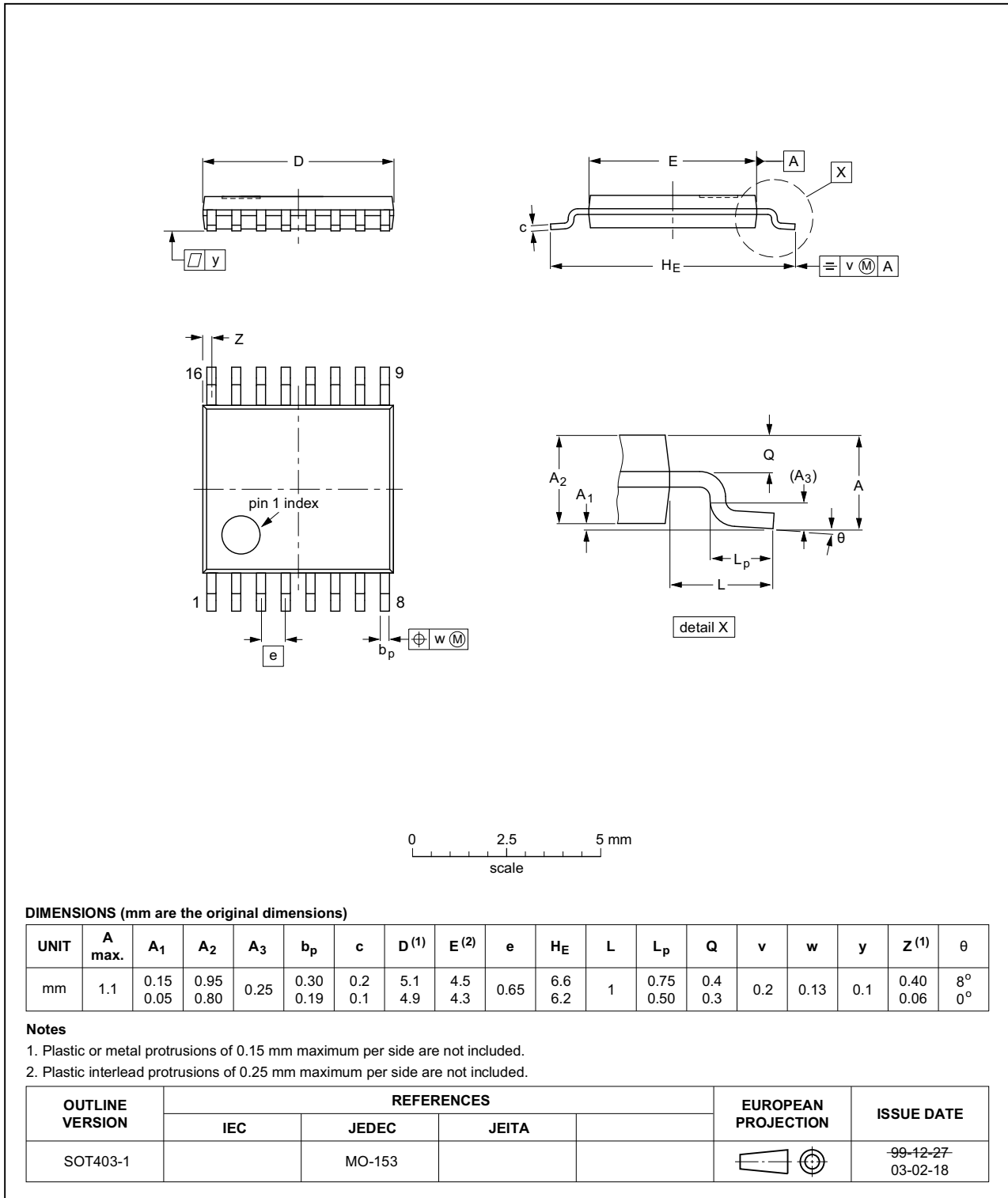


Fig 14. Package outline SOT403-1 (TSSOP16)

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_Q100 v.2 | 20140224 | Product data sheet | - | 74LV165_Q100 v.1 |
| Modifications: | • Typo corrected in Table 2 "Pin description" | | | |
| 74LV165_Q100 v.1 | 20131111 | Product data sheet | - | - |

15. Legal information

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| 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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17. Contents

| | | |
|-----------|---|-----------|
| 1 | General description | 1 |
| 2 | Features and benefits | 1 |
| 3 | Ordering information | 2 |
| 4 | Functional diagram | 2 |
| 5 | Pinning information | 4 |
| 5.1 | Pinning | 4 |
| 5.2 | Pin description | 4 |
| 6 | Functional description | 5 |
| 7 | Limiting values | 6 |
| 8 | Recommended operating conditions | 6 |
| 9 | Static characteristics | 7 |
| 10 | Dynamic characteristics | 8 |
| 11 | Waveforms | 10 |
| 12 | Package outline | 14 |
| 13 | Abbreviations | 16 |
| 14 | Revision history | 16 |
| 15 | Legal information | 17 |
| 15.1 | Data sheet status | 17 |
| 15.2 | Definitions | 17 |
| 15.3 | Disclaimers | 17 |
| 15.4 | Trademarks | 18 |
| 16 | Contact information | 18 |
| 17 | Contents | 19 |

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