

# 74AHC594-Q100; 74AHCT594-Q100

8-bit shift register with output register

Rev. 4 — 7 July 2021

Product data sheet

## 1. General description

The 74AHC594-Q100; 74AHCT594-Q100 is a high-speed Si-gate CMOS device and is pin compatible with Low-Power Schottky TTL (LSTTL). It is specified in compliance with JEDEC standard No. 7-A.

The 74AHC594-Q100; 74AHCT594-Q100 is an 8-bit, non-inverting, serial-in, parallel-out shift register that feeds an 8-bit D-type storage register. Separate clocks (SHCP and STCP) and direct overriding clears (SHR and STR) are provided on both the shift and storage registers. A serial output (Q7S) is provided for cascading purposes.

Both the shift and storage register clocks are positive-edge triggered. If the user wishes to connect both clocks together, the shift register will always be one count pulse ahead of the storage register.

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 °C to +85 °C and from -40 °C to +125 °C
- Wide supply voltage range from 2.0 V to 5.5 V
- Balanced propagation delays
- All inputs have Schmitt-trigger action
- Overvoltage tolerant inputs to 5.5 V
- High noise immunity
- CMOS low power dissipation
- 8-bit serial-in, parallel-out shift register with storage
- Independent direct overriding clears on shift and storage registers
- Independent clocks for shift and storage registers
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level A
- Input levels:
  - For 74AHC594-Q100: CMOS level
  - For 74AHCT594-Q100: TTL level
- ESD protection:
  - MIL-STD-883, method 3015 exceeds 2000 V
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V (C = 200 pf, R = 0 Ω)
- Multiple package options
- DHVQFN package with Side-Wettable Flanks enabling Automatic Optical Inspection (AOI) of solder joints

## 3. Applications

- Serial-to parallel data conversion
- Remote control holding register

### 4. Ordering information

Table 1. Ordering information

| Type number      | Package           |          |  | Version  |
|------------------|-------------------|----------|--|----------|
|                  | Temperature range | Name     | Description  |          |
| 74AHC594D-Q100   | -40 °C to +125 °C | SO16     | plastic small outline package; 16 leads; body width 3.9 mm   | SOT109-1 |
| 74AHCT594D-Q100  |                   |          |  |          |
| 74AHC594PW-Q100  | -40 °C to +125 °C | TSSOP16  | plastic thin shrink small outline package; 16 leads; body width 4.4 mm   | SOT403-1 |
| 74AHCT594PW-Q100 |                   |          |  |          |
| 74AHC594BQ-Q100  | -40 °C to +125 °C | DHVQFN16 | plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 × 3.5 × 0.85 mm | SOT763-1 |
| 74AHCT594BQ-Q100 |                   |          |  |          |

### 5. Functional diagram

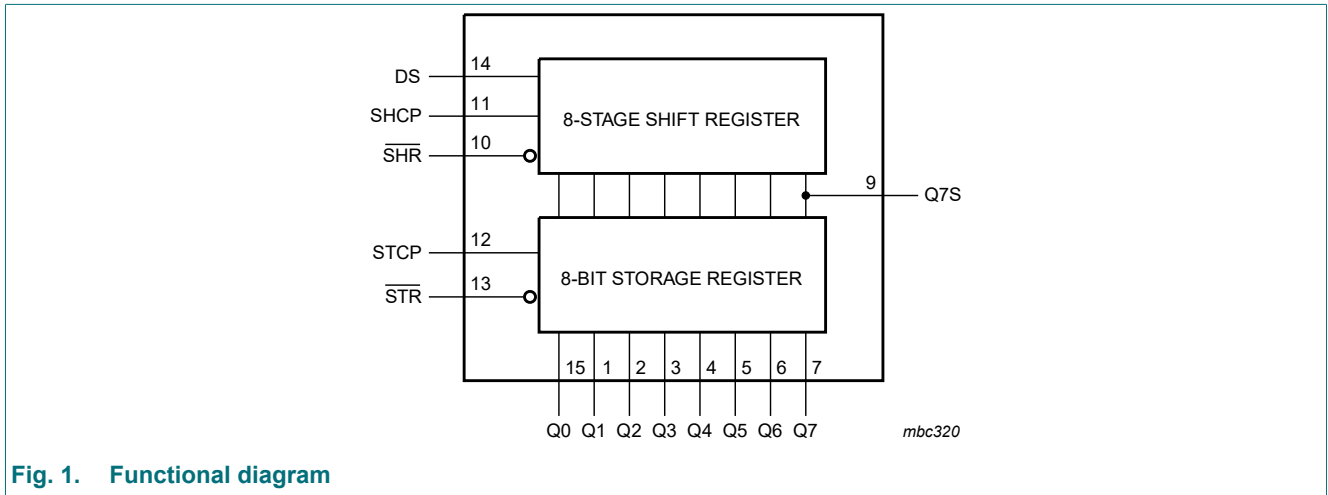


Fig. 1. Functional diagram

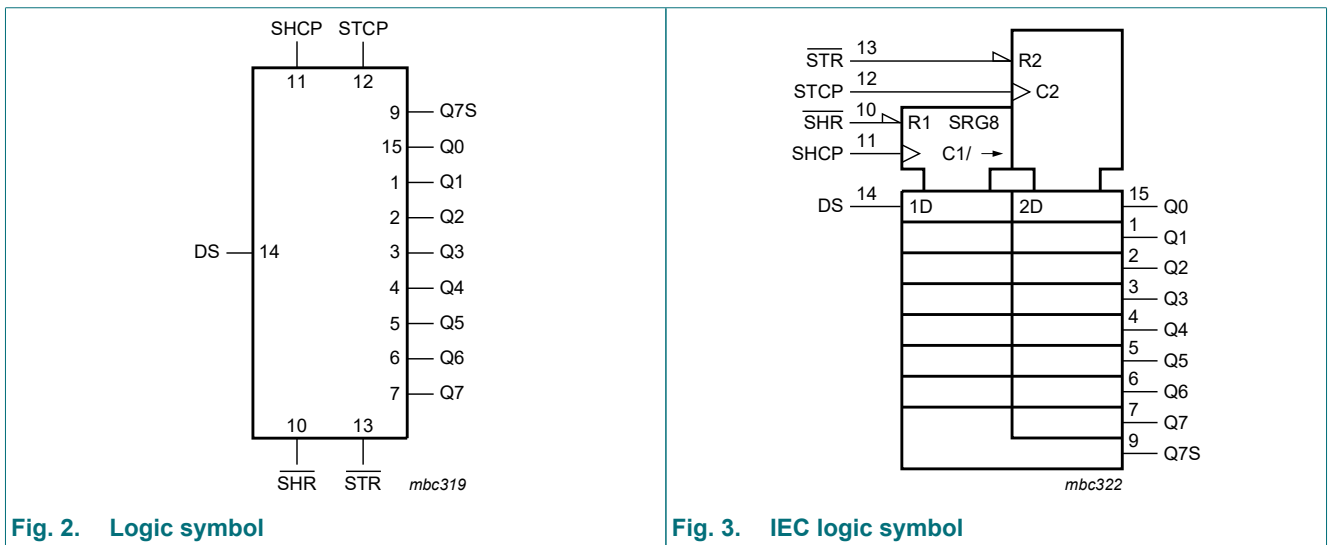


Fig. 2. Logic symbol

Fig. 3. IEC logic symbol

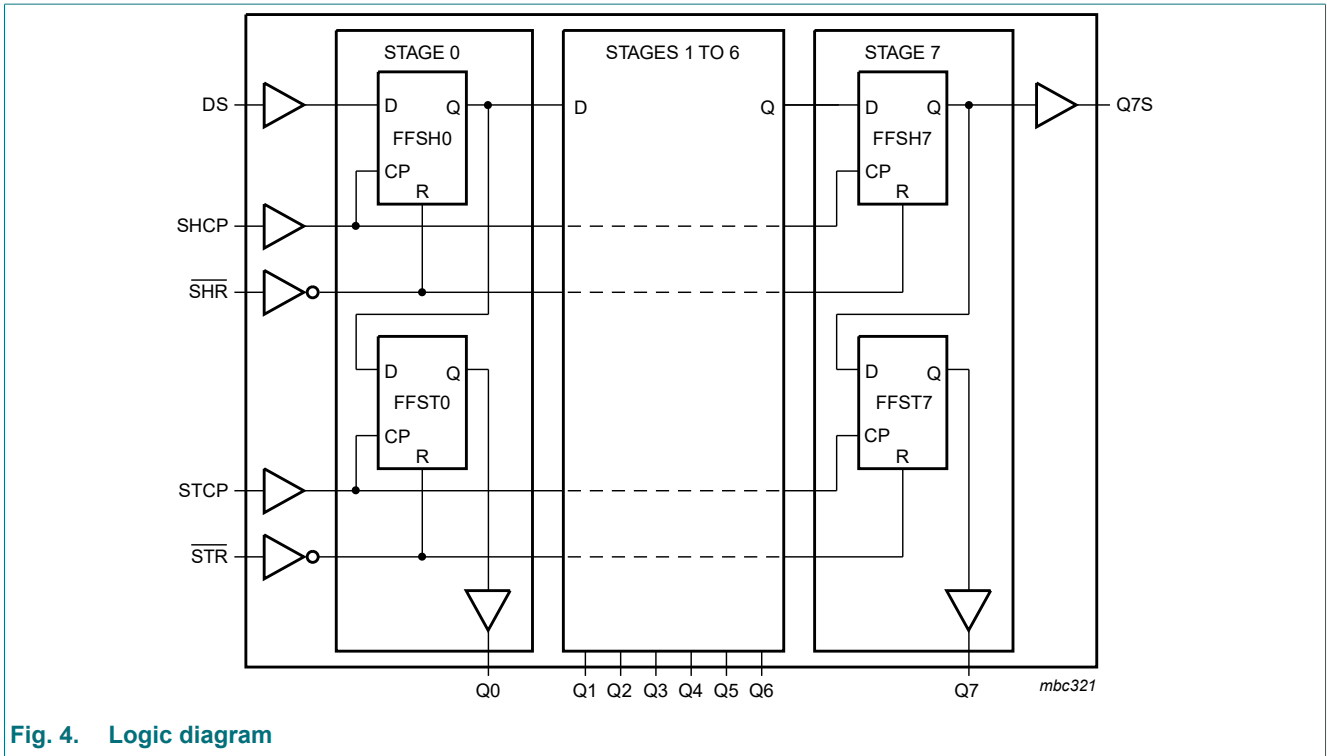


Fig. 4. Logic diagram

## 6. Pinning information

### 6.1. Pinning

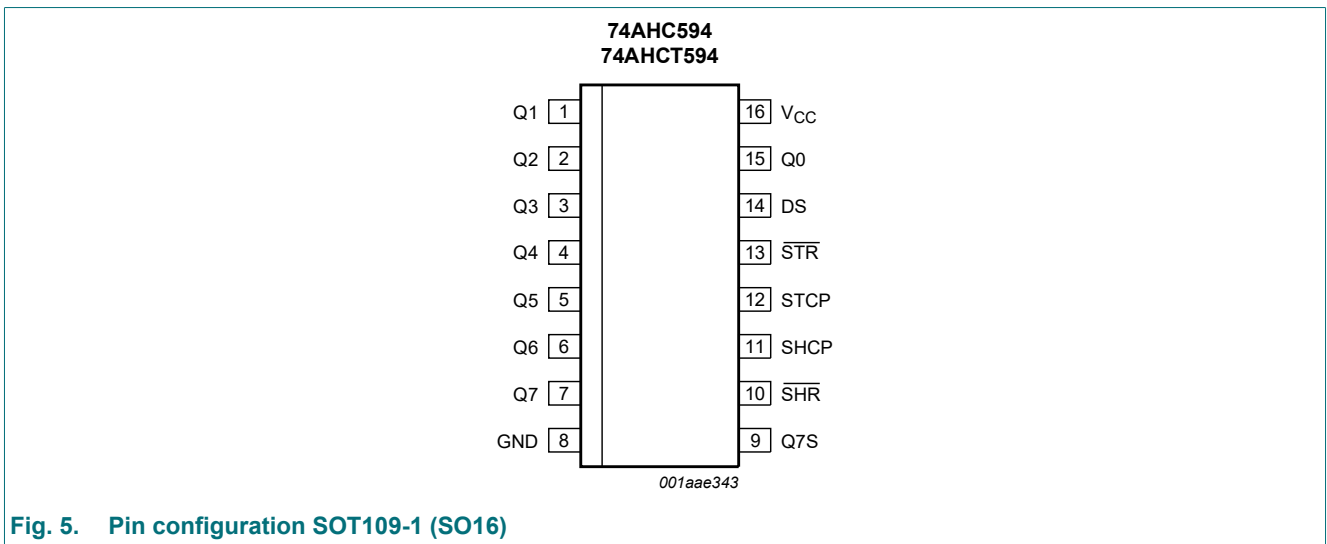


Fig. 5. Pin configuration SOT109-1 (SO16)

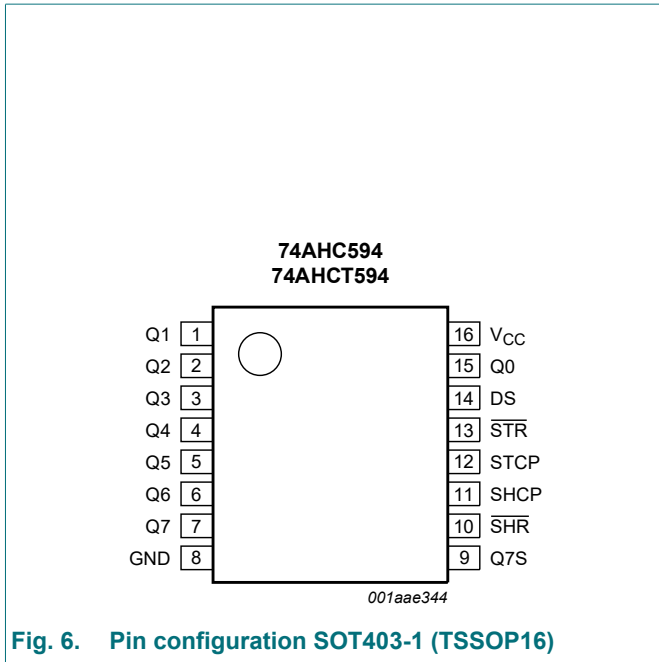


Fig. 6. Pin configuration SOT403-1 (TSSOP16)

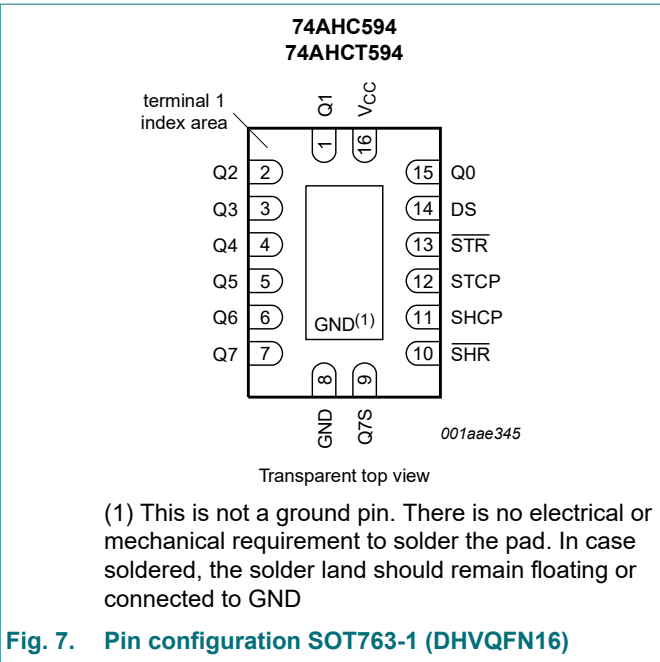


Fig. 7. Pin configuration SOT763-1 (DHVQFN16)

## 6.2. Pin description

Table 2. Pin description

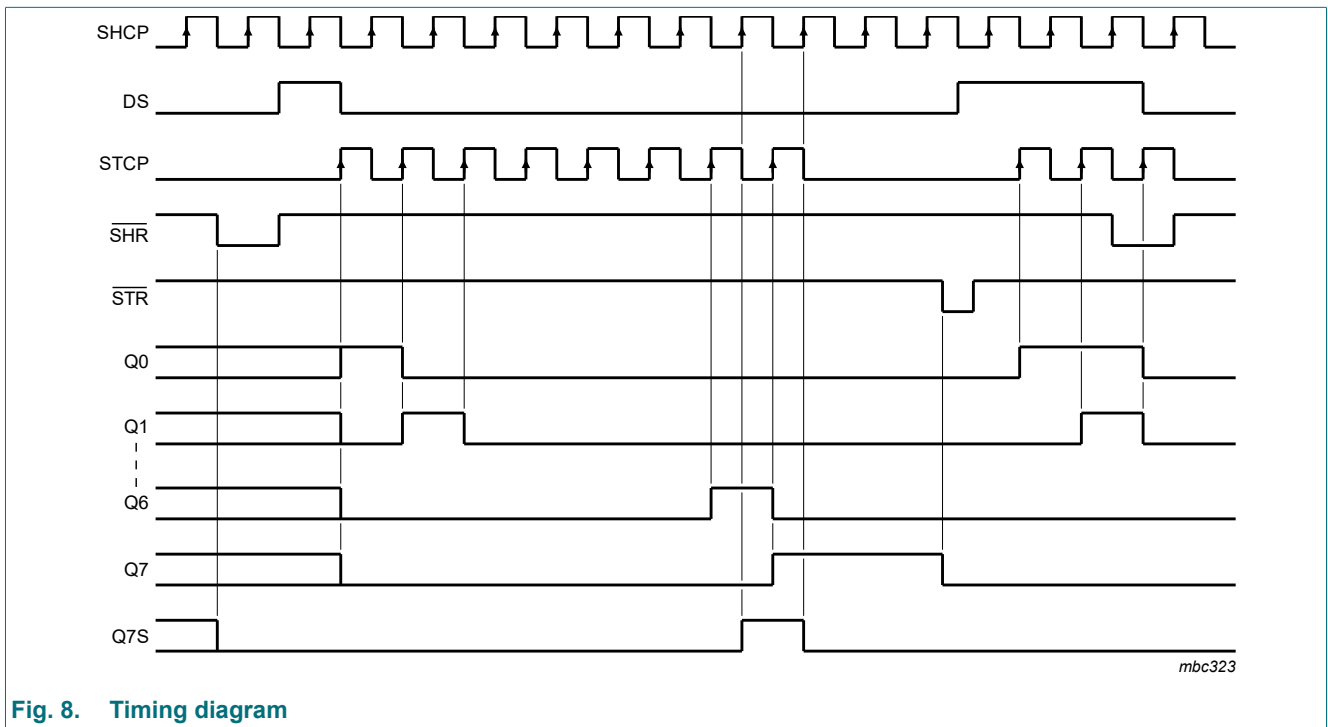
| Symbol                         | Pin                     | Description                               |
|--------------------------------|-------------------------|---|
| Q0, Q1, Q2, Q3, Q4, Q5, Q6, Q7 | 15, 1, 2, 3, 4, 5, 6, 7 | parallel data output                      |
| GND                            | 8                       | ground (0 V)                              |
| Q7S                            | 9                       | serial data output                        |
| SHR                            | 10                      | shift register reset input (active LOW)   |
| SHCP                           | 11                      | shift register clock input                |
| STCP                           | 12                      | storage register clock input              |
| STR                            | 13                      | storage register reset input (active LOW) |
| DS                             | 14                      | serial data input                         |
| V <sub>CC</sub>                | 16                      | supply voltage                            |

## 7. Functional description

**Table 3. Function table**

H = HIGH voltage state; L = LOW voltage state; ↑ = LOW to HIGH transition; X = don't care; NC = no change.

| Input |      |     |     |    | Output |     | Function   |
|-------|------|-----|-----|----|--------|-----|--|
| SHCP  | STCP | SHR | STR | DS | Q7S    | Qn  |  |
| X     | X    | L   | X   | X  | L      | NC  | a LOW-state on $\overline{\text{SHR}}$ only affects the shift register   |
| X     | X    | X   | L   | X  | NC     | L   | a LOW-state on $\overline{\text{STR}}$ only affects the storage register   |
| X     | ↑    | L   | H   | X  | L      | L   | empty shift register loaded into storage register  |
| ↑     | X    | H   | X   | H  | Q6S    | NC  | logic HIGH level shifted into shift register stage 0. Contents of all shift register stages shifted through, e.g. previous state of stage 6 (internal Q6S) appears on the serial output (Q7S). |
| X     | ↑    | H   | H   | X  | NC     | QnS | contents of shift register stages (internal QnS) are transferred to the storage register and parallel output stages  |
| ↑     | ↑    | H   | H   | X  | Q6S    | QnS | contents of shift register shifted through; previous contents of the shift register is transferred to the storage register and the parallel output stages                                      |



**Fig. 8. Timing diagram**

## 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 | +7.0 | V    |
| $V_I$     | input voltage           |  | -0.5 | +7.0 | V    |
| $I_{IK}$  | input clamping current  | $V_I < -0.5$ V [1]                           | -20  | -    | mA   |
| $I_{OK}$  | output clamping current | $V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V [1] | -20  | +20  | mA   |
| $I_O$     | output current          | $V_O = -0.5$ V to $(V_{CC} + 0.5$ V)         | -25  | +25  | mA   |
| $I_{CC}$  | supply current          |  | -    | +75  | mA   |
| $I_{GND}$ | ground current          |  | -75  | -    | mA   |
| $T_{stg}$ | storage temperature     |  | -65  | +150 | °C   |
| $P_{tot}$ | total power dissipation | $T_{amb} = -40$ °C to +125 °C [2]            | -    | 500  | 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.

For SOT403-1 (TSSOP16) package:  $P_{tot}$  derates linearly with 8.5 mW/K above 91 °C.

For SOT763-1 (DHVQFN16) package:  $P_{tot}$  derates linearly with 11.2 mW/K above 106 °C.

## 9. Recommended operating conditions

**Table 5. Operating conditions**

| Symbol              | Parameter                           | Conditions                | 74AHC594-Q100 |     |          | 74AHCT594-Q100 |     |          | Unit |
|---------------------|-------------------------------------|---------------------------|---------------|-----|----------|----------------|-----|----------|------|
|                     |                                     |                           | Min           | Typ | Max      | Min            | Typ | Max      |      |
| $V_{CC}$            | supply voltage                      |                           | 2.0           | 5.0 | 5.5      | 4.5            | 5.0 | 5.5      | V    |
| $V_I$               | input voltage                       |                           | 0             | -   | 5.5      | 0              | -   | 5.5      | V    |
| $V_O$               | output voltage                      |                           | 0             | -   | $V_{CC}$ | 0              | -   | $V_{CC}$ | V    |
| $T_{amb}$           | ambient temperature                 |                           | -40           | +25 | +125     | -40            | +25 | +125     | °C   |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 3.0$ V to 3.6 V | -             | -   | 100      | -              | -   | -        | ns/V |
|                     |                                     | $V_{CC} = 4.5$ V to 5.5 V | -             | -   | 20       | -              | -   | 20       | 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  |      |
| <b>74AHC594-Q100</b> |                           |   |       |     |      |                  |      |                   |      |      |
| V <sub>IH</sub>      | HIGH-level input voltage  | V <sub>CC</sub> = 2.0 V   | 1.5   | -   | -    | 1.5              | -    | 1.5               | -    | V    |
|                      |                           | V <sub>CC</sub> = 3.0 V   | 2.1   | -   | -    | 2.1              | -    | 2.1               | -    | V    |
|                      |                           | V <sub>CC</sub> = 5.5 V   | 3.85  | -   | -    | 3.85             | -    | 3.85              | -    | V    |
| V <sub>IL</sub>      | LOW-level input voltage   | V <sub>CC</sub> = 2.0 V   | -     | -   | 0.5  | -                | 0.5  | -                 | 0.5  | V    |
|                      |                           | V <sub>CC</sub> = 3.0 V   | -     | -   | 0.9  | -                | 0.9  | -                 | 0.9  | V    |
|                      |                           | V <sub>CC</sub> = 5.5 V   | -     | -   | 1.65 | -                | 1.65 | -                 | 1.65 | 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> = -50 μA; V <sub>CC</sub> = 2.0 V  | 1.9   | 2.0 | -    | 1.9              | -    | 1.9               | -    | V    |
|                      |                           | I <sub>O</sub> = -50 μA; V <sub>CC</sub> = 3.0 V  | 2.9   | 3.0 | -    | 2.9              | -    | 2.9               | -    | V    |
|                      |                           | I <sub>O</sub> = -50 μA; V <sub>CC</sub> = 4.5 V  | 4.4   | 4.5 | -    | 4.4              | -    | 4.4               | -    | V    |
|                      |                           | I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 3.0 V   | 2.58  | -   | -    | 2.48             | -    | 2.40              | -    | V    |
|                      |                           | I <sub>O</sub> = -8.0 mA; V <sub>CC</sub> = 4.5 V   | 3.94  | -   | -    | 3.80             | -    | 3.70              | -    | 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> = 50 μA; V <sub>CC</sub> = 2.0 V   | -     | 0   | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                      |                           | I <sub>O</sub> = 50 μA; V <sub>CC</sub> = 3.0 V   | -     | 0   | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                      |                           | I <sub>O</sub> = 50 μA; V <sub>CC</sub> = 4.5 V   | -     | 0   | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                      |                           | I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 3.0 V  | -     | -   | 0.36 | -                | 0.44 | -                 | 0.55 | V    |
|                      |                           | I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 4.5 V  | -     | -   | 0.36 | -                | 0.44 | -                 | 0.55 | V    |
| I <sub>I</sub>       | input leakage current     | V <sub>I</sub> = 5.5 V or GND;<br>V <sub>CC</sub> = 0 V to 5.5 V                          | -     | -   | 0.1  | -                | 1.0  | -                 | 2.0  | μA   |
| I <sub>CC</sub>      | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A;<br>V <sub>CC</sub> = 5.5 V | -     | -   | 4.0  | -                | 40   | -                 | 80   | μA   |
| C <sub>I</sub>       | input capacitance         | V <sub>I</sub> = V <sub>CC</sub> or GND   | -     | 3   | 10   | -                | 10   | -                 | 10   | pF   |

| Symbol                | Parameter                 | Conditions   | 25 °C |     |      | -40 °C to +85 °C |      | -40 °C to +125 °C |      | Unit |
|-----------------------|---------------------------|--|-------|-----|------|------------------|------|-------------------|------|------|
|                       |                           |  | Min   | Typ | Max  | Min              | Max  | Min               | Max  |      |
| <b>74AHCT594-Q100</b> |                           |  |       |     |      |                  |      |                   |      |      |
| V <sub>IH</sub>       | HIGH-level input voltage  | V <sub>CC</sub> = 4.5 V to 5.5 V   | 2.0   | -   | -    | 2.0              | -    | 2.0               | -    | V    |
| V <sub>IL</sub>       | LOW-level input voltage   | V <sub>CC</sub> = 4.5 V to 5.5 V   | -     | -   | 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>  |       |     |      |                  |      |                   |      |      |
|                       |                           | I <sub>O</sub> = -50 µA; V <sub>CC</sub> = 4.5 V   | 4.4   | 4.5 | -    | 4.4              | -    | 4.4               | -    | V    |
|                       |                           | I <sub>O</sub> = -8.0 mA; V <sub>CC</sub> = 4.5 V  | 3.94  | -   | -    | 3.80             | -    | 3.70              | -    | 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> = 50 µA; V <sub>CC</sub> = 4.5 V  | -     | 0   | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                       |                           | I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 4.5 V   | -     | -   | 0.36 | -                | 0.44 | -                 | 0.55 | V    |
| I <sub>I</sub>        | input leakage current     | V <sub>I</sub> = 5.5 V or GND;<br>V <sub>CC</sub> = 0 V to 5.5 V   | -     | -   | 0.1  | -                | 1.0  | -                 | 2.0  | µA   |
| I <sub>CC</sub>       | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A;<br>V <sub>CC</sub> = 5.5 V  | -     | -   | 4.0  | -                | 40   | -                 | 80   | µA   |
| ΔI <sub>CC</sub>      | additional supply current | per input pin;<br>V <sub>I</sub> = V <sub>CC</sub> - 2.1 V; other pins<br>at V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A;<br>V <sub>CC</sub> = 4.5 V to 5.5 V | -     | -   | 1.35 | -                | 1.5  | -                 | 1.5  | mA   |
| C <sub>I</sub>        | input capacitance         | V <sub>I</sub> = V <sub>CC</sub> or GND  | -     | 3   | 10   | -                | 10   | -                 | 10   | pF   |

## 11. Dynamic characteristics

**Table 7. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 15.

| Symbol                 | Parameter                     | Conditions                       | 25 °C |        |      | -40 °C to +85 °C |      | -40 °C to +125 °C |      | Unit |
|------------------------|-------------------------------|----------------------------------|-------|--------|------|------------------|------|-------------------|------|------|
|                        |                               |                                  | Min   | Typ[1] | Max  | Min              | Max  | Min               | Max  |      |
| <b>74AHC594-Q100</b>   |                               |                                  |       |        |      |                  |      |                   |      |      |
| t <sub>PLH</sub>       | LOW to HIGH propagation delay | SHCP to Q7S; see Fig. 9          |       |        |      |                  |      |                   |      |      |
|                        |                               | V <sub>CC</sub> = 3.0 V to 3.6 V |       |        |      |                  |      |                   |      |      |
|                        |                               | C <sub>L</sub> = 15 pF           | -     | 5.2    | 8.5  | 2.2              | 9.7  | 2.2               | 10.6 | ns   |
|                        |                               | C <sub>L</sub> = 50 pF           | -     | 7.4    | 11.5 | 3.0              | 13.2 | 3.0               | 14.3 | ns   |
|                        |                               | V <sub>CC</sub> = 4.5 V to 5.5 V |       |        |      |                  |      |                   |      |      |
|                        |                               | C <sub>L</sub> = 15 pF           | -     | 3.8    | 6.3  | 1.7              | 7.2  | 1.7               | 7.8  | ns   |
|                        |                               | C <sub>L</sub> = 50 pF           | -     | 4.8    | 8.0  | 2.4              | 9.1  | 2.4               | 10.0 | ns   |
|                        |                               | STCP to Qn; see Fig. 10          |       |        |      |                  |      |                   |      |      |
|                        |                               | V <sub>CC</sub> = 3.0 V to 3.6 V |       |        |      |                  |      |                   |      |      |
|                        |                               | C <sub>L</sub> = 15 pF           | -     | 5.1    | 8.3  | 2.3              | 9.5  | 2.3               | 10.6 | ns   |
|                        |                               | C <sub>L</sub> = 50 pF           | -     | 7.3    | 11.9 | 3.3              | 13.6 | 3.3               | 14.7 | ns   |
|                        |                               | V <sub>CC</sub> = 4.5 V to 5.5 V |       |        |      |                  |      |                   |      |      |
| C <sub>L</sub> = 15 pF | -                             | 3.5                              | 5.7   | 1.8    | 6.5  | 1.8              | 7.1  | ns                |      |      |
| C <sub>L</sub> = 50 pF | -                             | 4.8                              | 7.8   | 2.6    | 9.0  | 2.6              | 9.8  | ns                |      |      |



| Symbol                                 | Parameter                     | Conditions  | 25 °C |        |      | -40 °C to +85 °C |      | -40 °C to +125 °C |      | Unit |
|--|-------------------------------|---|-------|--------|------|------------------|------|-------------------|------|------|
|  |                               |   | Min   | Typ[1] | Max  | Min              | Max  | Min               | Max  |      |
| t <sub>PHL</sub>                       | HIGH to LOW propagation delay | SHCP to Q7S; see <a href="#">Fig. 9</a>   |       |        |      |                  |      |                   |      |      |
|  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V  |       |        |      |                  |      |                   |      |      |
|  |                               | C <sub>L</sub> = 15 pF  | -     | 5.5    | 8.9  | 2.3              | 10.2 | 2.3               | 11.0 | ns   |
|  |                               | C <sub>L</sub> = 50 pF  | -     | 7.4    | 12.1 | 3.0              | 13.9 | 3.0               | 15.1 | ns   |
|  |                               | V <sub>CC</sub> = 4.5 V to 5.5 V  |       |        |      |                  |      |                   |      |      |
|  |                               | C <sub>L</sub> = 15 pF  | -     | 4.1    | 6.7  | 1.9              | 7.6  | 1.9               | 8.2  | ns   |
|  |                               | C <sub>L</sub> = 50 pF  | -     | 5.4    | 8.8  | 2.5              | 10.1 | 2.5               | 11.0 | ns   |
|  |                               | STCP to Qn; see <a href="#">Fig. 10</a>   |       |        |      |                  |      |                   |      |      |
|  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V  |       |        |      |                  |      |                   |      |      |
|  |                               | C <sub>L</sub> = 15 pF  | -     | 5.5    | 9.1  | 2.4              | 10.4 | 2.4               | 11.3 | ns   |
|  |                               | C <sub>L</sub> = 50 pF  | -     | 7.3    | 12.0 | 3.2              | 13.8 | 3.2               | 15.0 | ns   |
|  |                               | V <sub>CC</sub> = 4.5 V to 5.5 V  |       |        |      |                  |      |                   |      |      |
|  |                               | C <sub>L</sub> = 15 pF  | -     | 3.7    | 6.0  | 1.9              | 6.9  | 1.9               | 7.5  | ns   |
|  |                               | C <sub>L</sub> = 50 pF  | -     | 5.2    | 8.5  | 2.6              | 9.7  | 2.6               | 10.5 | ns   |
|  |                               | SHR to Q7S; see <a href="#">Fig. 13</a>   |       |        |      |                  |      |                   |      |      |
|  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V  |       |        |      |                  |      |                   |      |      |
|  |                               | C <sub>L</sub> = 15 pF  | -     | 5.7    | 9.5  | 2.3              | 10.8 | 2.3               | 11.7 | ns   |
|  |                               | C <sub>L</sub> = 50 pF  | -     | 7.5    | 12.2 | 3.6              | 14.0 | 3.6               | 15.2 | ns   |
|  |                               | V <sub>CC</sub> = 4.5 V to 5.5 V  |       |        |      |                  |      |                   |      |      |
|  |                               | C <sub>L</sub> = 15 pF  | -     | 4.1    | 6.7  | 2.0              | 7.6  | 2.0               | 8.2  | ns   |
| C <sub>L</sub> = 50 pF                 | -                             | 5.4   | 8.8   | 2.8    | 10.1 | 2.8              | 11.0 | ns                |      |      |
| STR to Qn; see <a href="#">Fig. 12</a> |                               |   |       |        |      |                  |      |                   |      |      |
| V <sub>CC</sub> = 3.0 V to 3.6 V       |                               |   |       |        |      |                  |      |                   |      |      |
| C <sub>L</sub> = 15 pF                 | -                             | 5.8   | 9.6   | 2.8    | 11.0 | 2.8              | 12.0 | ns                |      |      |
| C <sub>L</sub> = 50 pF                 | -                             | 7.7   | 12.5  | 3.8    | 14.4 | 3.8              | 15.6 | ns                |      |      |
| V <sub>CC</sub> = 4.5 V to 5.5 V       |                               |   |       |        |      |                  |      |                   |      |      |
| C <sub>L</sub> = 15 pF                 | -                             | 4.1   | 7.2   | 2.2    | 8.2  | 2.2              | 8.9  | ns                |      |      |
| C <sub>L</sub> = 50 pF                 | -                             | 5.4   | 9.4   | 3.0    | 10.7 | 3.0              | 11.6 | ns                |      |      |
| f <sub>max</sub>                       | maximum frequency             | SHCP or STCP; see <a href="#">Fig. 9</a> and <a href="#">Fig. 10</a>              |       |        |      |                  |      |                   |      |      |
|  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V  | 80    | 125    | -    | 70               | -    | 65                | -    | MHz  |
|  |                               | V <sub>CC</sub> = 4.5 V to 5.5 V  | 90    | 170    | -    | 80               | -    | 70                | -    | MHz  |
| t <sub>W</sub>                         | pulse width                   | SHCP and STCP HIGH or LOW; see <a href="#">Fig. 9</a> and <a href="#">Fig. 10</a> |       |        |      |                  |      |                   |      |      |
|  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V  | 6.0   | -      | -    | 6.5              | -    | 7.0               | -    | ns   |
|  |                               | V <sub>CC</sub> = 4.5 V to 5.5 V  | 5.5   | -      | -    | 6.0              | -    | 6.5               | -    | ns   |
|  |                               | SHR and STR HIGH or LOW; see <a href="#">Fig. 13</a> and <a href="#">Fig. 12</a>  |       |        |      |                  |      |                   |      |      |
|  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V  | 5.0   | -      | -    | 5.0              | -    | 5.5               | -    | ns   |
|  |                               | V <sub>CC</sub> = 4.5 V to 5.5 V  | 5.0   | -      | -    | 5.2              | -    | 5.7               | -    | ns   |

| Symbol   | Parameter                     | Conditions  | 25 °C |        |      | -40 °C to +85 °C |      | -40 °C to +125 °C |      | Unit |
|--|-------------------------------|---|-------|--------|------|------------------|------|-------------------|------|------|
|  |                               |   | Min   | Typ[1] | Max  | Min              | Max  | Min               | Max  |      |
| t <sub>su</sub>  | set-up time                   | DS to SHCP; see Fig. 11   |       |        |      |                  |      |                   |      |      |
|  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                    | 3.5   | -      | -    | 3.5              | -    | 4.0               | -    | ns   |
|  |                               | V <sub>CC</sub> = 4.5 V to 5.5 V                                    | 3.0   | -      | -    | 3.0              | -    | 3.5               | -    | ns   |
|  |                               | SHR to STCP; see Fig. 14  |       |        |      |                  |      |                   |      |      |
|  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                    | 8.0   | -      | -    | 9.0              | -    | 9.5               | -    | ns   |
|  |                               | V <sub>CC</sub> = 4.5 V to 5.5 V                                    | 5.0   | -      | -    | 5.0              | -    | 5.5               | -    | ns   |
|  |                               | SHCP to STCP; see Fig. 10   |       |        |      |                  |      |                   |      |      |
|  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                    | 8.0   | -      | -    | 8.5              | -    | 9.0               | -    | ns   |
| V <sub>CC</sub> = 4.5 V to 5.5 V                       | 5.0                           | -   | -     | 5.0    | -    | 5.5              | -    | ns                |      |      |
| t <sub>h</sub>   | hold time                     | DS to SHCP; see Fig. 11   |       |        |      |                  |      |                   |      |      |
|  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                    | 1.5   | -      | -    | 1.5              | -    | 2.0               | -    | ns   |
|  |                               | V <sub>CC</sub> = 4.5 V to 5.5 V                                    | 2.0   | -      | -    | 2.0              | -    | 2.5               | -    | ns   |
| t <sub>rec</sub>                                       | recovery time                 | SHR to SHCP; see Fig. 13  |       |        |      |                  |      |                   |      |      |
|  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                    | 4.2   | -      | -    | 4.8              | -    | 5.3               | -    | ns   |
|  |                               | V <sub>CC</sub> = 4.5 V to 5.5 V                                    | 2.9   | -      | -    | 3.3              | -    | 3.8               | -    | ns   |
|  |                               | STR to STCP; see Fig. 12  |       |        |      |                  |      |                   |      |      |
|  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                    | 4.6   | -      | -    | 5.3              | -    | 5.8               | -    | ns   |
| V <sub>CC</sub> = 4.5 V to 5.5 V                       | 3.2                           | -   | -     | 3.7    | -    | 4.3              | -    | ns                |      |      |
| C <sub>PD</sub>  | power dissipation capacitance | f <sub>i</sub> = 1 MHz; V <sub>i</sub> = GND to V <sub>CC</sub> [2] | -     | 55     | -    | -                | -    | -                 | -    | pF   |
| <b>74AHCT594-Q100; V<sub>CC</sub> = 4.5 V to 5.5 V</b> |                               |   |       |        |      |                  |      |                   |      |      |
| t <sub>PLH</sub>                                       | LOW to HIGH propagation delay | SHCP to Q7S; see Fig. 9   |       |        |      |                  |      |                   |      |      |
|  |                               | C <sub>L</sub> = 15 pF  | -     | 3.8    | 6.3  | 1.7              | 7.2  | 1.7               | 7.8  | ns   |
|  |                               | C <sub>L</sub> = 50 pF  | -     | 4.8    | 8.0  | 2.2              | 9.1  | 2.2               | 9.9  | ns   |
|  |                               | STCP to Qn; see Fig. 10   |       |        |      |                  |      |                   |      |      |
|  |                               | C <sub>L</sub> = 15 pF  | -     | 3.5    | 5.7  | 1.8              | 6.5  | 1.8               | 7.1  | ns   |
| C <sub>L</sub> = 50 pF                                 | -                             | 4.6   | 7.7   | 2.6    | 8.8  | 2.6              | 9.6  | ns                |      |      |
| t <sub>PHL</sub>                                       | HIGH to LOW propagation delay | SHCP to Q7S; see Fig. 9   |       |        |      |                  |      |                   |      |      |
|  |                               | C <sub>L</sub> = 15 pF  | -     | 4.1    | 6.7  | 1.8              | 7.6  | 1.8               | 8.3  | ns   |
|  |                               | C <sub>L</sub> = 50 pF  | -     | 5.4    | 8.8  | 2.4              | 10.1 | 2.4               | 11.0 | ns   |
|  |                               | STCP to Qn; see Fig. 10   |       |        |      |                  |      |                   |      |      |
|  |                               | C <sub>L</sub> = 15 pF  | -     | 3.7    | 6.1  | 1.9              | 6.9  | 1.9               | 7.2  | ns   |
|  |                               | C <sub>L</sub> = 50 pF  | -     | 5.2    | 8.5  | 2.6              | 9.7  | 2.6               | 10.5 | ns   |
|  |                               | SHR to Q7S; see Fig. 13   |       |        |      |                  |      |                   |      |      |
|  |                               | C <sub>L</sub> = 15 pF  | -     | 4.3    | 7.0  | 2.4              | 8.0  | 2.4               | 8.7  | ns   |
|  |                               | C <sub>L</sub> = 50 pF  | -     | 5.4    | 8.8  | 2.7              | 10.1 | 2.7               | 11.0 | ns   |
| STR to Qn; see Fig. 12                                 |                               |   |       |        |      |                  |      |                   |      |      |
| C <sub>L</sub> = 15 pF                                 | -                             | 4.5   | 7.4   | 2.3    | 8.4  | 2.3              | 9.2  | ns                |      |      |
| C <sub>L</sub> = 50 pF                                 | -                             | 5.7   | 9.4   | 3.1    | 10.7 | 3.1              | 11.7 | ns                |      |      |
| f <sub>max</sub>                                       | maximum frequency             | SHCP or STCP; see Fig. 9 and Fig. 10                                | 90    | 160    | -    | 80               | -    | 70                | -    | MHz  |

| Symbol           | Parameter                     | Conditions  | 25 °C |        |     | -40 °C to +85 °C |     | -40 °C to +125 °C |     | Unit |
|------------------|-------------------------------|---|-------|--------|-----|------------------|-----|-------------------|-----|------|
|                  |                               |   | Min   | Typ[1] | Max | Min              | Max | Min               | Max |      |
| t <sub>W</sub>   | pulse width                   | SHCP and STCP HIGH or LOW; see Fig. 9 and Fig. 10                   | 5.5   | -      | -   | 6.0              | -   | 6.5               | -   | ns   |
|                  |                               | SHR and STR HIGH or LOW; see Fig. 13 and Fig. 12                    | 5.2   | -      | -   | 5.5              | -   | 6.0               | -   | ns   |
| t <sub>su</sub>  | set-up time                   | DS to SHCP; see Fig. 11   | 3.0   | -      | -   | 3.0              | -   | 3.5               | -   | ns   |
|                  |                               | SHR to STCP; see Fig. 14  | 5.0   | -      | -   | 5.0              | -   | 5.5               | -   | ns   |
|                  |                               | SHCP to STCP; see Fig. 10   | 5.0   | -      | -   | 5.0              | -   | 5.5               | -   | ns   |
| t <sub>h</sub>   | hold time                     | DS to SHCP; see Fig. 11   | 2.0   | -      | -   | 2.0              | -   | 2.5               | -   | ns   |
| t <sub>rec</sub> | recovery time                 | SHR to SHCP; see Fig. 13  | 2.9   | -      | -   | 3.3              | -   | 3.8               | -   | ns   |
|                  |                               | STR to STCP; see Fig. 12  | 3.4   | -      | -   | 3.8              | -   | 4.3               | -   | ns   |
| C <sub>PD</sub>  | power dissipation capacitance | f <sub>i</sub> = 1 MHz; V <sub>i</sub> = GND to V <sub>CC</sub> [2] | -     | 55     | -   | -                | -   | -                 | -   | pF   |

[1] Typical values are measured at nominal supply voltage (V<sub>CC</sub> = 3.3 V and V<sub>CC</sub> = 5.0 V).

[2] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).

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

where:

f<sub>i</sub> = input frequency in MHz;

f<sub>o</sub> = output frequency in MHz;

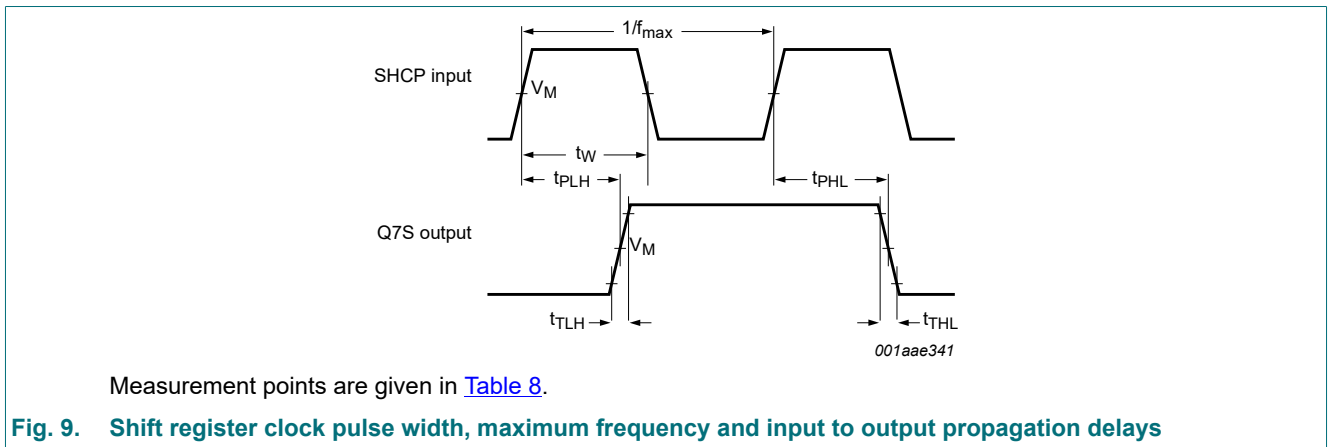
C<sub>L</sub> = output load capacitance in pF;

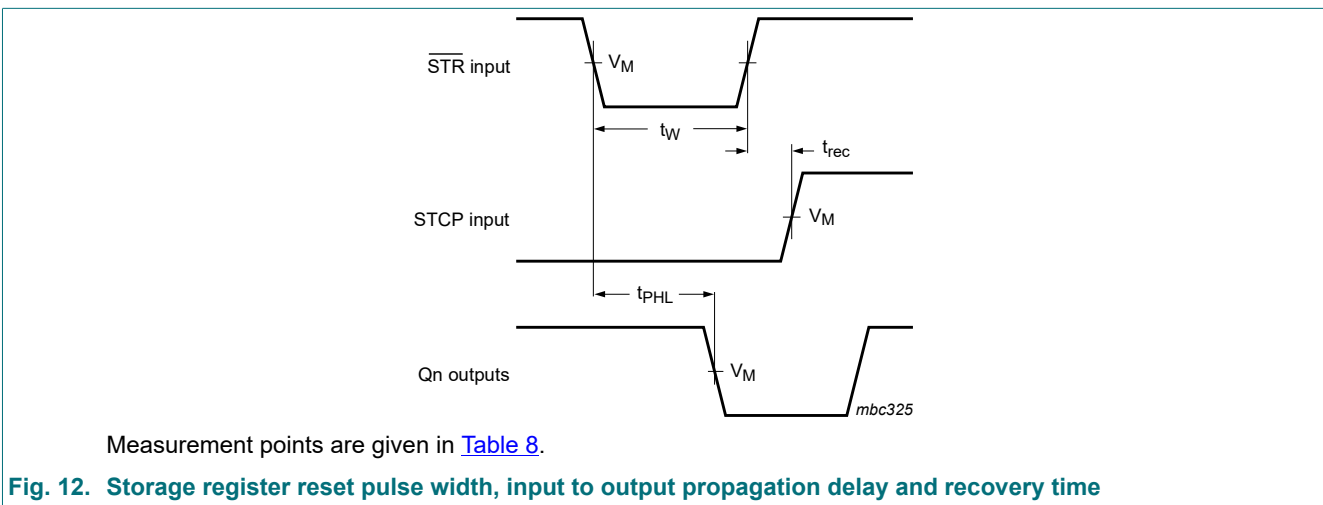
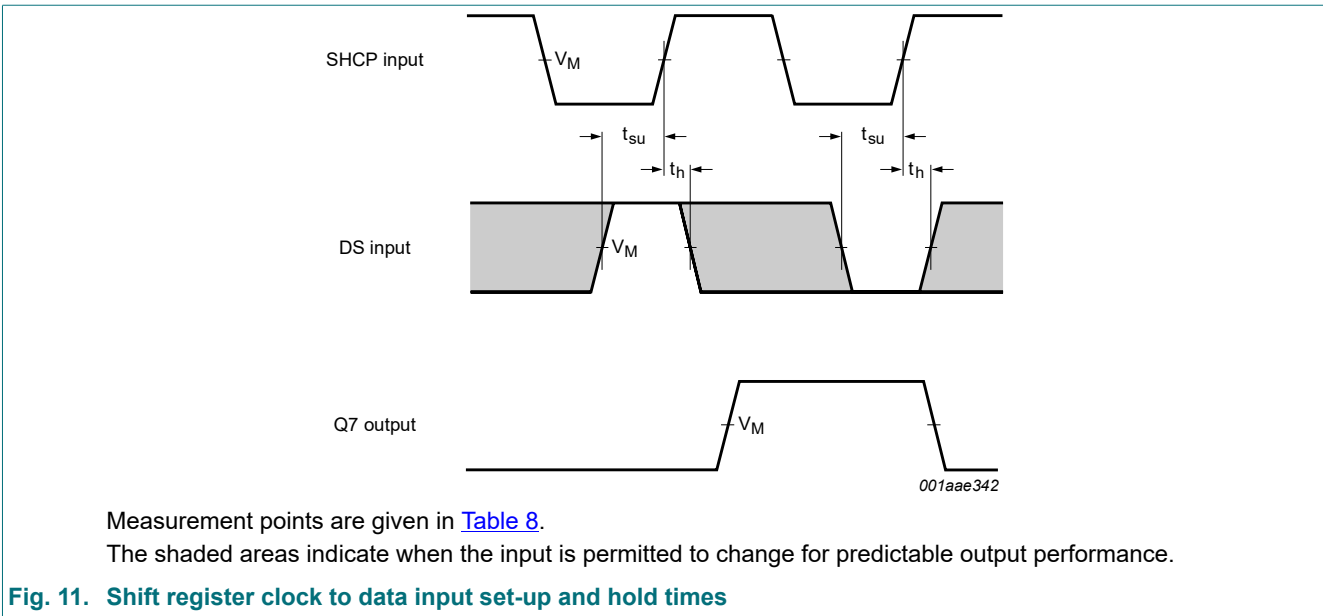
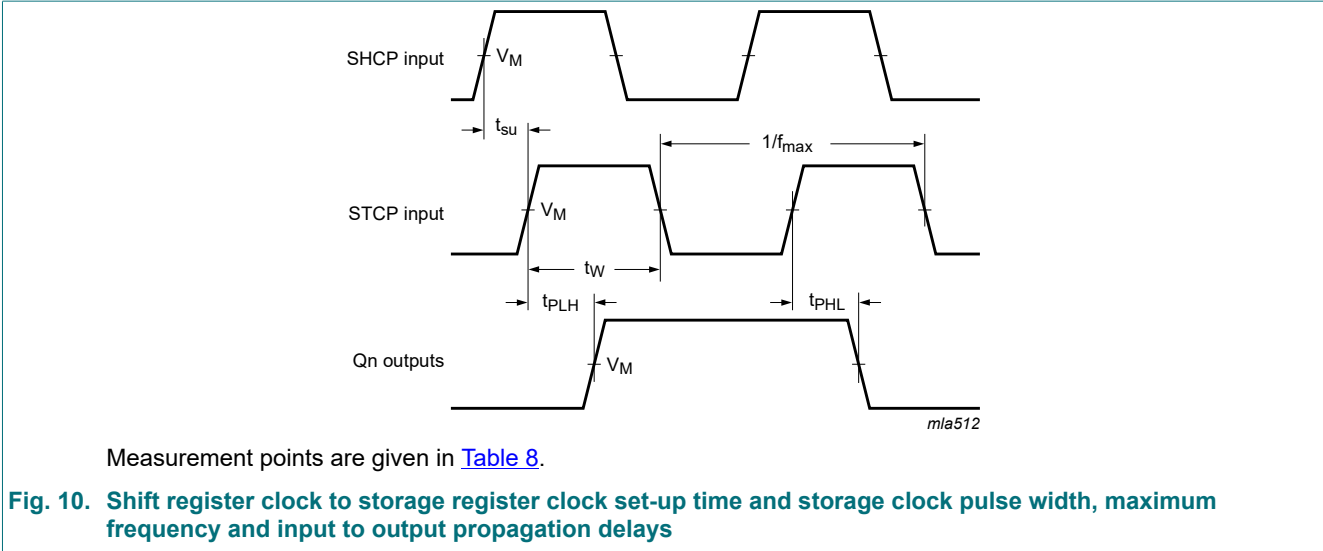
V<sub>CC</sub> = supply voltage in V;

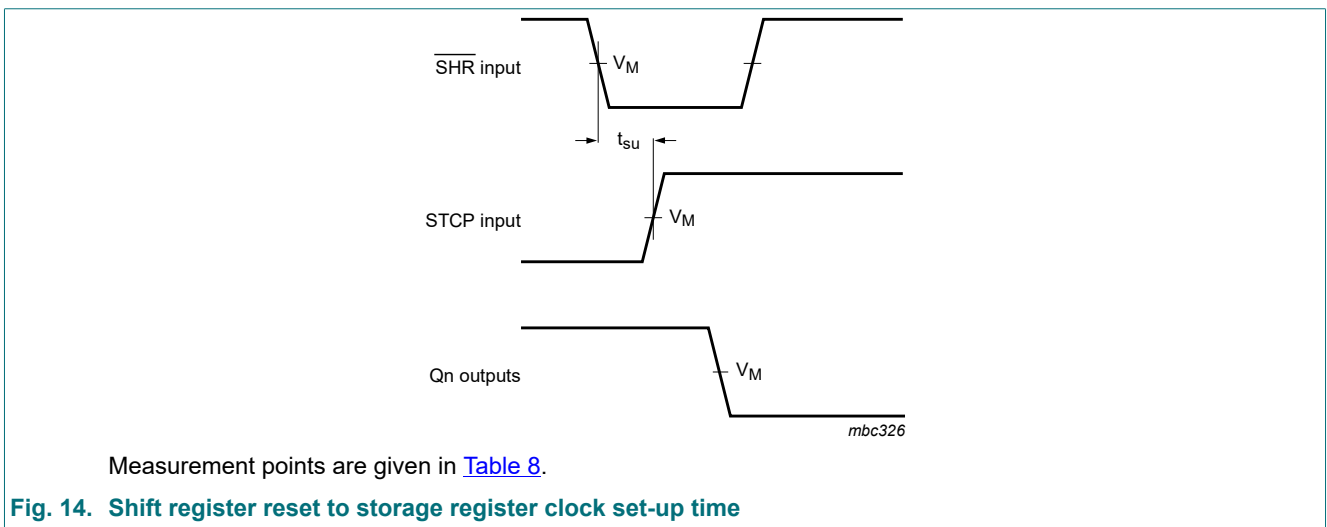
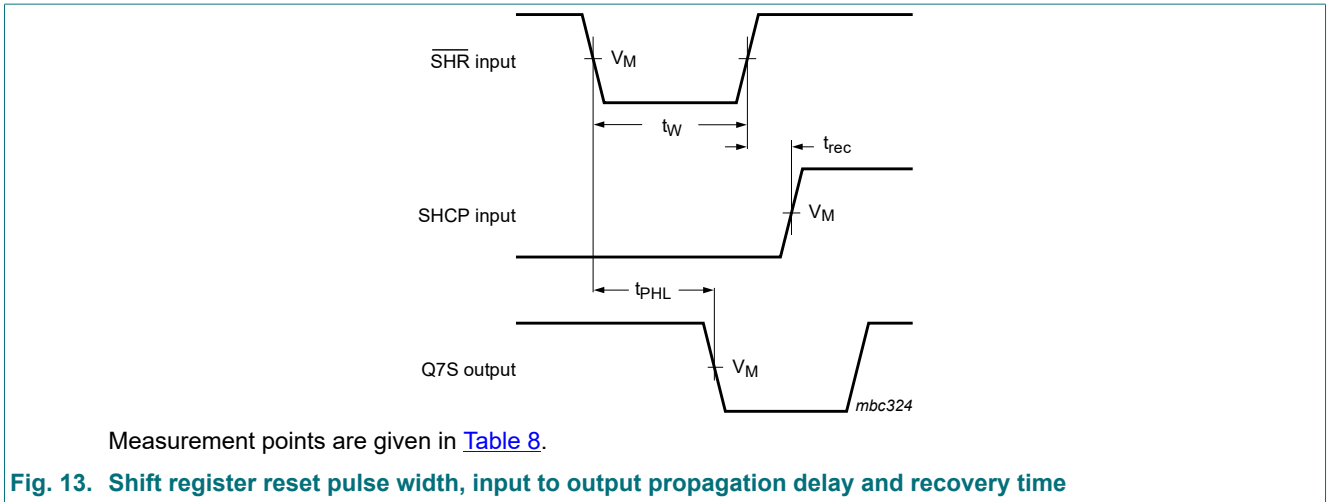
N = number of inputs switching;

∑(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of the outputs.

### 11.1. Waveforms and test circuit

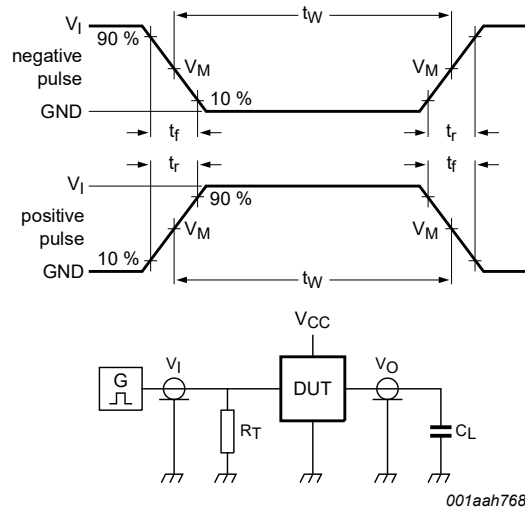






**Table 8. Measurement points**

| Type           | Input                 | Output                |
|----------------|-----------------------|-----------------------|
|                | V <sub>M</sub>        | V <sub>M</sub>        |
| 74AHC594-Q100  | 0.5 x V <sub>CC</sub> | 0.5 x V <sub>CC</sub> |
| 74AHCT594-Q100 | 1.5 V                 | 0.5 x V <sub>CC</sub> |



001aah768

For test data see [Table 9](#).

Definitions for test circuit:

$R_T$  = Termination resistance should be equal to output impedance  $Z_o$  of the pulse generator.

$C_L$  = Load capacitance including jig and probe capacitance.

**Fig. 15. Test circuit for measuring switching times**

**Table 9. Test data**

| Type           | Input    |               | Load         | Test               |
|----------------|----------|---------------|--------------|--------------------|
|                | $V_I$    | $t_r, t_f$    | $C_L$        |                    |
| 74AHC594-Q100  | $V_{CC}$ | $\leq 3.0$ ns | 15 pF, 50 pF | $t_{PLH}, t_{PHL}$ |
| 74AHCT594-Q100 | 3.0 V    | $\leq 3.0$ ns | 15 pF, 50 pF | $t_{PLH}, t_{PHL}$ |

## 12. Package outline

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

SOT109-1

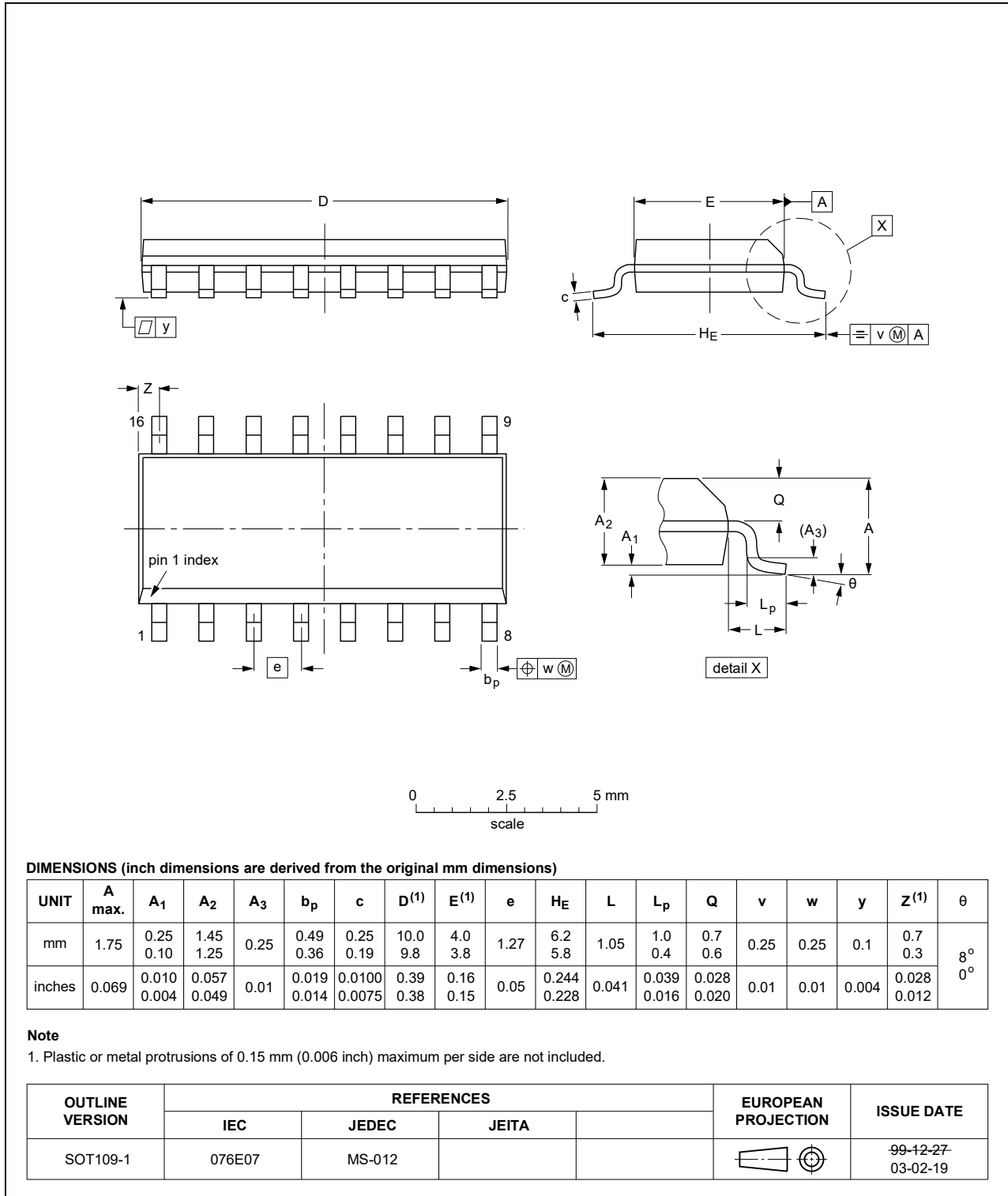


Fig. 16. Package outline SOT109-1 (SO16)

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

SOT403-1

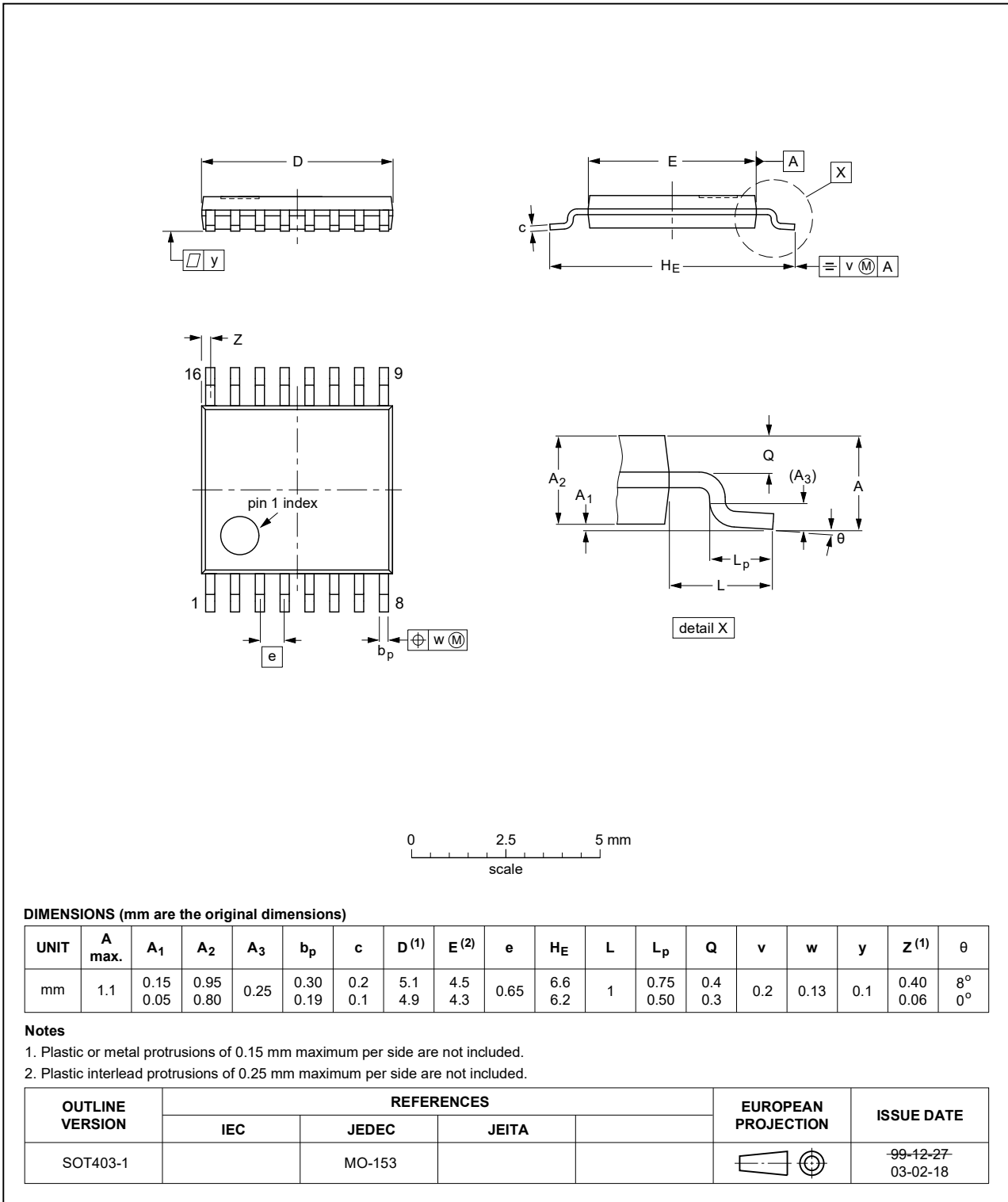


Fig. 17. Package outline SOT403-1 (TSSOP16)



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

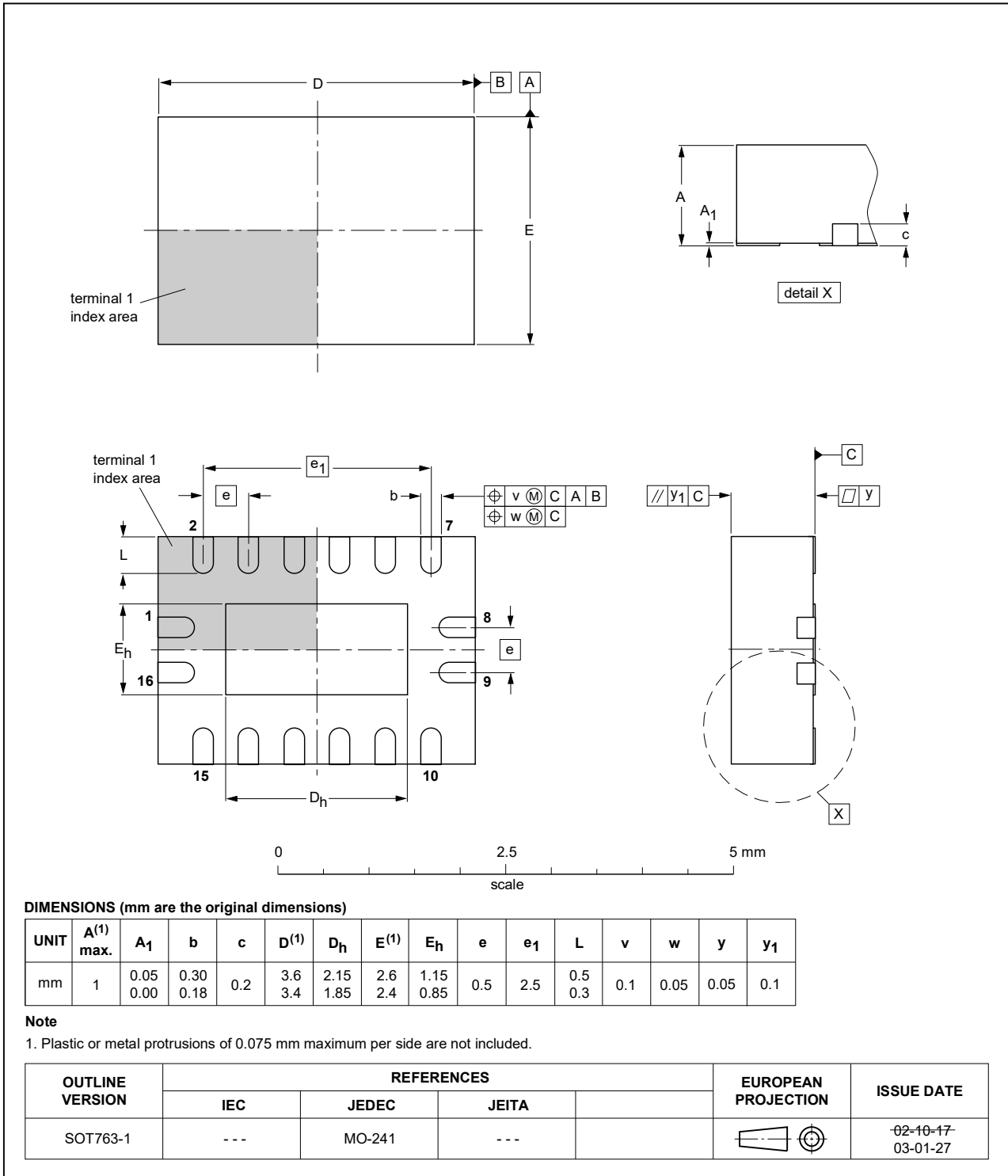


Fig. 18. Package outline SOT763-1 (DHVQFN16)

## 13. Abbreviations

Table 10. Abbreviations

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

## 14. Revision history

Table 11. Revision history

| Document ID            | Release date  | Data sheet status  | Change notice | Supersedes             |
|------------------------|---|--------------------|---------------|------------------------|
| 74AHC_AHCT594_Q100 v.4 | 20210707  | Product data sheet | -             | 74AHC_AHCT594_Q100 v.3 |
| Modifications:         | <ul style="list-style-type: none"> <li>Type number 74AHCT594DB-Q100 (SOT338-1/SSOP16) removed.</li> </ul>   |                    |               |                        |
| 74AHC_AHCT594_Q100 v.3 | 20200625  | Product data sheet | -             | 74AHC_AHCT594_Q100 v.2 |
| Modifications:         | <ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li>Type number 74AHC594DB-Q100 (SOT338-1/SSOP16) removed.</li> <li><a href="#">Section 2</a> updated.</li> <li><a href="#">Table 4</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li> </ul> |                    |               |                        |
| 74AHC_AHCT594_Q100 v.2 | 20130704  | Product data sheet | -             | 74AHC_AHCT594_Q100 v.1 |
| Modifications:         | <ul style="list-style-type: none"> <li>74AHC594DB-Q100 and 74AHCT594DB-Q100 added.</li> </ul>   |                    |               |                        |
| 74AHC_AHCT594_Q100 v.1 | 20120712  | Product data sheet | -             | -                      |

## 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".
- [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 <https://www.nexperia.com>.

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