

# 74HC594-Q100; 74HCT594-Q100

## 8-bit shift register with output register

Rev. 3 — 12 August 2021

Product data sheet

## 1. General description

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The 74HC594-Q100; 74HCT594-Q100 is an 8-bit serial-in/serial or parallel-out shift register with a storage register. Separate clock and reset inputs are provided on both shift and storage registers. The device features a serial input (DS) and a serial output (Q7S) to enable cascading. Data is shifted on the LOW-to-HIGH transitions of the SHCP input, and the data in the shift register is transferred to the storage register on a LOW-to-HIGH transition of the STCP input. If both clocks are connected together, the shift register will always be one clock pulse ahead of the storage register. A LOW level on one of the two register reset pins (SHR and STR) will clear the corresponding register. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ .

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

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- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- Synchronous serial input and output
- 8-bit parallel output
- Shift and storage registers have independent direct clear and clocks
- Independent clocks for shift and storage registers
- 100 MHz (typical)
- Wide supply voltage range from 2.0 to 6.0 V
- CMOS low power dissipation
- High noise immunity
- Complies with JEDEC standards
  - JESD8C (2.7 V to 3.6 V)
  - JESD7A (2.0 V to 6.0 V)
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Input levels:
  - For 74HC594: CMOS level
  - For 74HCT594: 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)

## 3. Applications

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

### 4. Ordering information

Table 1. Ordering information

| Type number    | Package           |         |  | Version  |
|----------------|-------------------|---------|--|----------|
|                | Temperature range | Name    | Description  |          |
| 74HC594D-Q100  | -40 °C to +125 °C | SO16    | plastic small outline package; 16 leads; body width 3.9 mm             | SOT109-1 |
| 74HCT594D-Q100 |                   |         |  |          |
| 74HC594PW-Q100 | -40 °C to +125 °C | TSSOP16 | plastic thin shrink small outline package; 16 leads; body width 4.4 mm | SOT403-1 |

### 5. Functional diagram

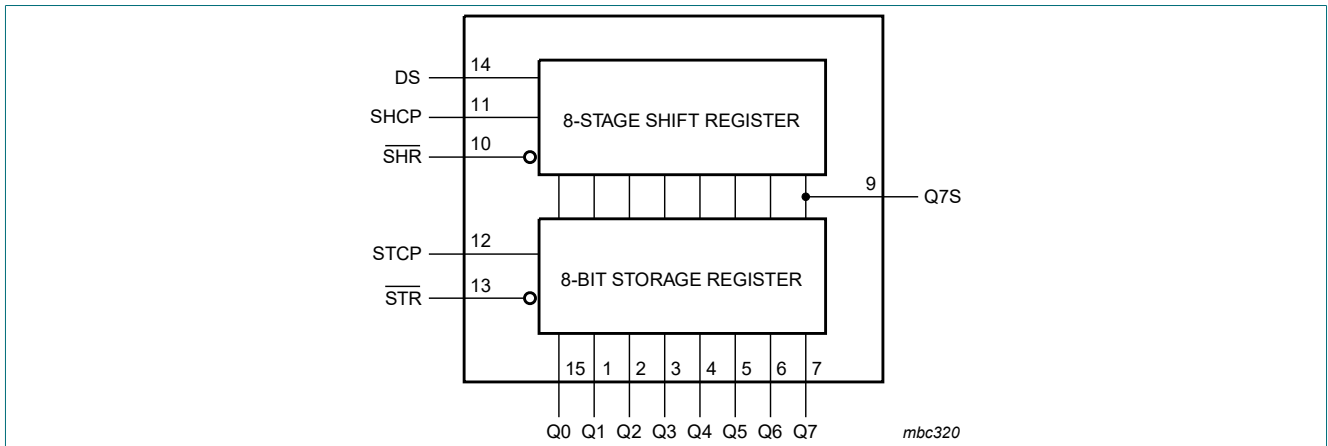


Fig. 1. Functional diagram

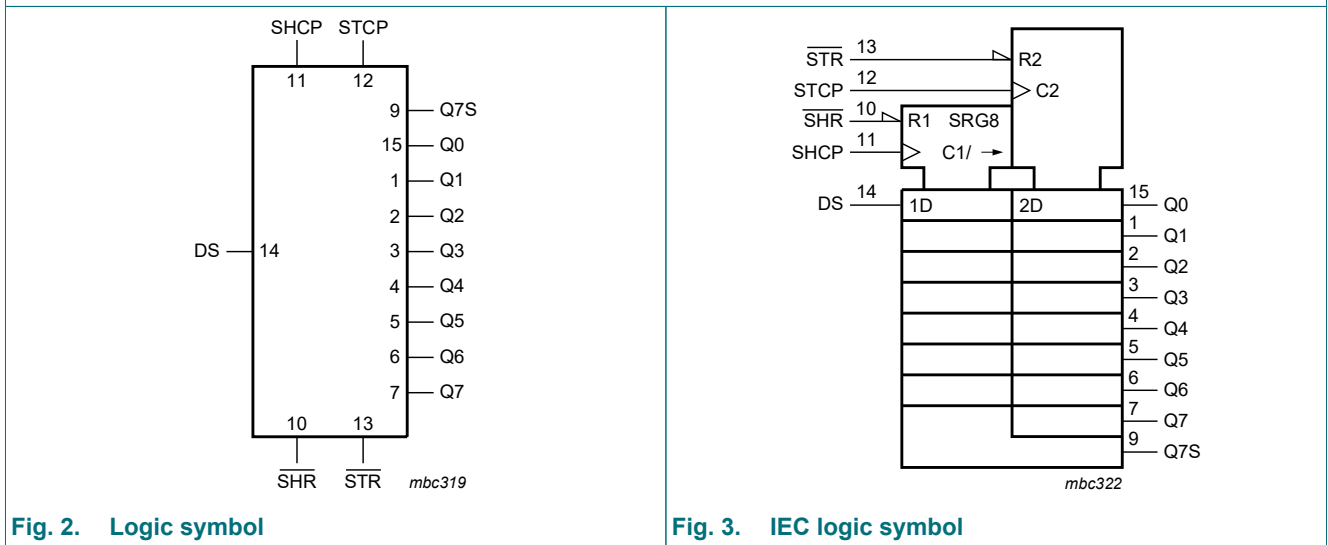


Fig. 2. Logic symbol

Fig. 3. IEC logic symbol

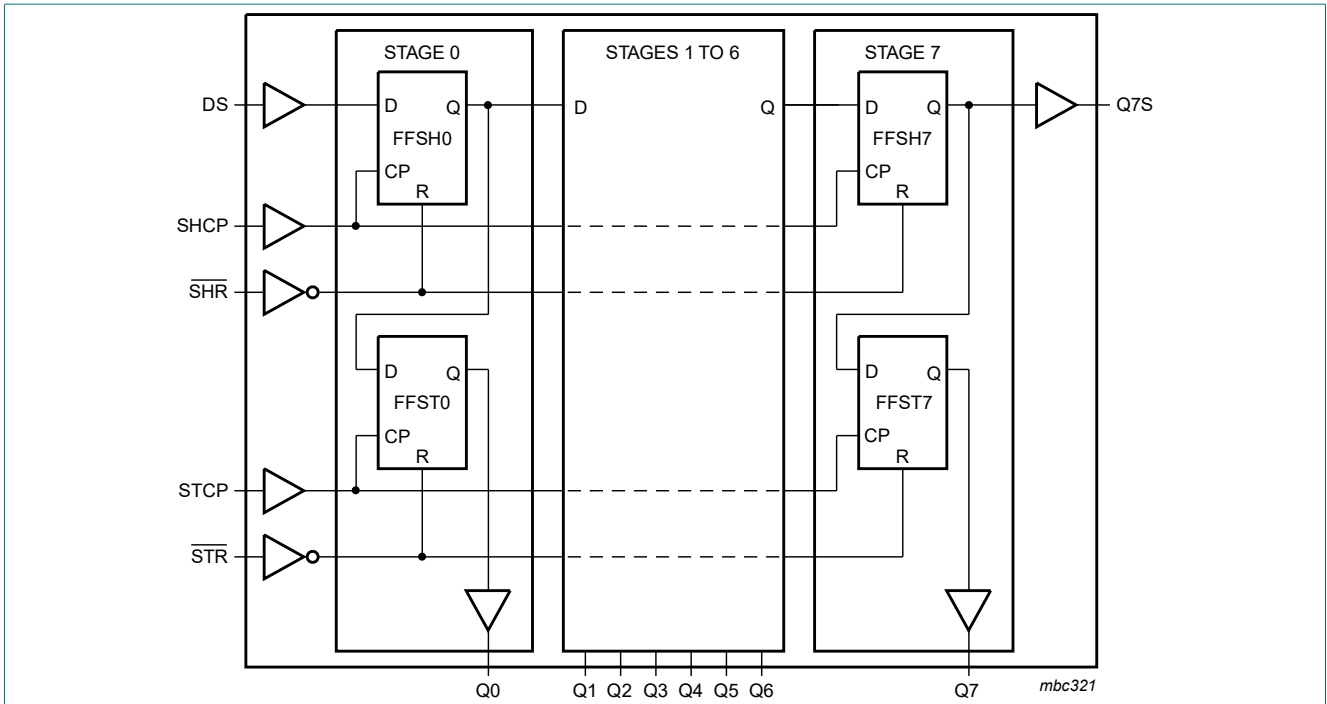


Fig. 4. Logic diagram

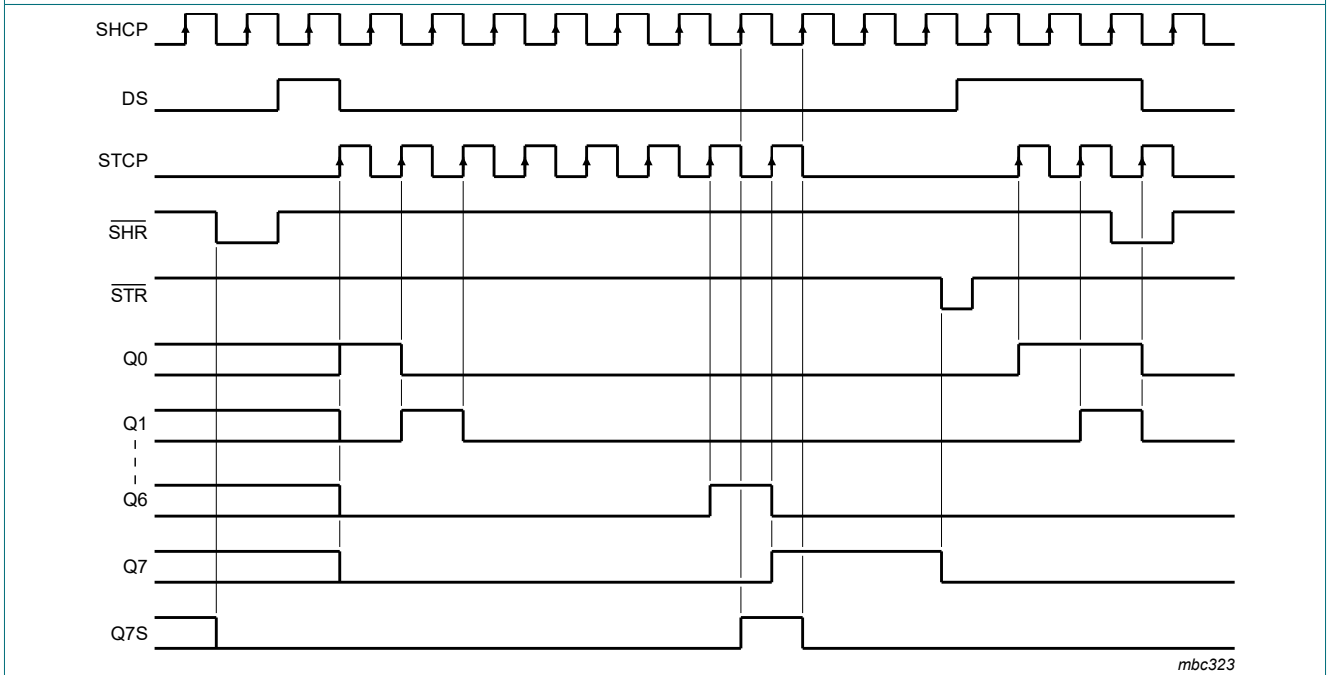


Fig. 5. Timing diagram

## 6. Pinning information

### 6.1. Pinning

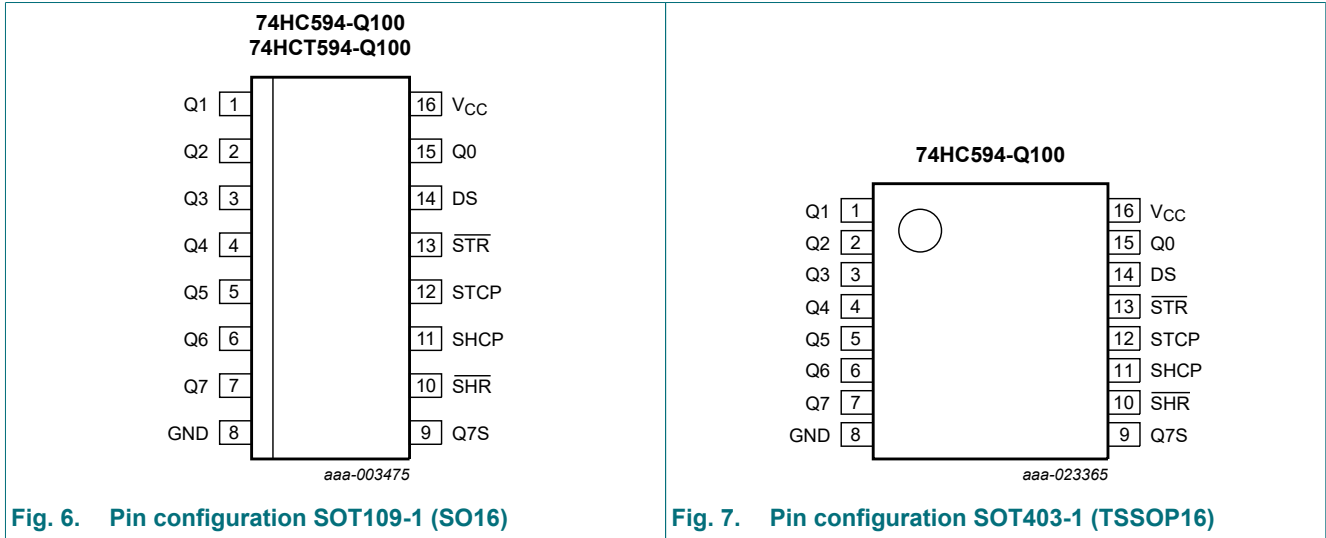


Fig. 6. Pin configuration SOT109-1 (SO16)

Fig. 7. Pin configuration SOT403-1 (TSSOP16)

### 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 (active LOW)   |
| SHCP                           | 11                      | shift register clock input          |
| STCP                           | 12                      | storage register clock input        |
| STR                            | 13                      | storage register reset (active LOW) |
| DS                             | 14                      | serial data input                   |
| V <sub>CC</sub>                | 16                      | supply voltage                      |

## 7. Functional description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level; ↑ = LOW-to-HIGH transition; X = don't care.

| Function   | Input |     |      |      |        |
|--|-------|-----|------|------|--------|
|  | SHR   | STR | SHCP | STCP | DS     |
| Clear shift register   | L     | X   | X    | X    | X      |
| Clear storage register   | X     | L   | X    | X    | X      |
| Load DS into shift register stage 0, advance previous stage data to the next stage | H     | X   | ↑    | X    | H or L |
| Transfer shift register data to storage register and outputs Qn                    | X     | H   | X    | ↑    | X      |
| Shift register one count pulse ahead of storage register                           | H     | H   | ↑    | ↑    | X      |

## 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    |
| $I_{IK}$  | input clamping current  | $V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$ [1] | -    | $\pm 20$ | mA   |
| $I_{OK}$  | output clamping current | $V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ [1] | -    | $\pm 20$ | mA   |
| $I_O$     | output current          | $V_O = -0.5\text{ V}$ to $V_{CC} + 0.5\text{ V}$           |      |          |      |
|           |                         | Serial data output Q7S                                     | -    | $\pm 25$ | mA   |
|           |                         | Parallel data output Qn                                    | -    | $\pm 35$ | mA   |
| $I_{CC}$  | supply current          | Serial data output Q7S                                     | -    | 50       | mA   |
|           |                         | Parallel data output Qn                                    | -    | 70       | mA   |
| $I_{GND}$ | ground current          | Serial data output Q7S                                     | -    | -50      | mA   |
|           |                         | Parallel data output Qn                                    | -    | -70      | mA   |
| $T_{stg}$ | storage temperature     |  | -65  | +150     | °C   |
| $P_{tot}$ | total power dissipation | $T_{amb} = -40\text{ °C}$ to $+125\text{ °C}$ [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.

## 9. Recommended operating conditions

**Table 5. Recommended operating conditions**

Voltages are referenced to GND (ground = 0 V)

| Symbol              | Parameter                           | Conditions              | 74HC594-Q100 |      |          | 74HCT594-Q100 |      |          | Unit |
|---------------------|-------------------------------------|-------------------------|--------------|------|----------|---------------|------|----------|------|
|                     |                                     |                         | Min          | Typ  | Max      | Min           | Typ  | Max      |      |
| $V_{CC}$            | supply voltage                      |                         | 2.0          | 5.0  | 6.0      | 4.5           | 5.0  | 5.5      | V    |
| $V_I$               | input voltage                       |                         | 0            | -    | $V_{CC}$ | 0             | -    | $V_{CC}$ | V    |
| $V_O$               | output voltage                      |                         | 0            | -    | $V_{CC}$ | 0             | -    | $V_{CC}$ | V    |
| $T_{amb}$           | ambient temperature                 |                         | -40          | -    | +125     | -40           | -    | +125     | °C   |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 2.0\text{ V}$ | -            | -    | 625      | -             | -    | -        | ns/V |
|                     |                                     | $V_{CC} = 4.5\text{ V}$ | -            | 1.67 | 139      | -             | 1.67 | 139      | ns/V |
|                     |                                     | $V_{CC} = 6.0\text{ V}$ | -            | -    | 83       | -             | -    | -        | ns/V |

## 10. Static characteristics

**Table 6. Static characteristics type 74HC594-Q100**

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

| Symbol                                    | Parameter                 | Conditions   | Min  | Typ  | Max  | Unit |
|---|---------------------------|--|------|------|------|------|
| <b>T<sub>amb</sub> = 25 °C</b>            |                           |  |      |      |      |      |
| V <sub>IH</sub>                           | HIGH-level input voltage  | V <sub>CC</sub> = 2.0 V  | 1.5  | 1.2  | -    | V    |
|   |                           | V <sub>CC</sub> = 4.5 V  | 3.15 | 2.4  | -    | V    |
|   |                           | V <sub>CC</sub> = 6.0 V  | 4.2  | 3.2  | -    | V    |
| V <sub>IL</sub>                           | LOW-level input voltage   | V <sub>CC</sub> = 2.0 V  | -    | 0.8  | 0.5  | V    |
|   |                           | V <sub>CC</sub> = 4.5 V  | -    | 2.1  | 1.35 | V    |
|   |                           | V <sub>CC</sub> = 6.0 V  | -    | 2.8  | 1.8  | V    |
| V <sub>OH</sub>                           | HIGH-level output voltage | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                    |      |      |      |      |
|   |                           | Q7S; I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V                                 | 3.98 | 4.32 | -    | V    |
|   |                           | Q7S; I <sub>O</sub> = -5.2 mA; V <sub>CC</sub> = 6.0 V                                 | 5.48 | 5.81 | -    | V    |
|   |                           | Qn; I <sub>O</sub> = -6.0 mA; V <sub>CC</sub> = 4.5 V                                  | 3.98 | 4.32 | -    | V    |
|   |                           | Qn; I <sub>O</sub> = -7.8 mA; V <sub>CC</sub> = 6.0 V                                  | 5.48 | 5.81 | -    | V    |
| V <sub>OL</sub>                           | LOW-level output voltage  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                    |      |      |      |      |
|   |                           | Q7S; I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V                                  | -    | 0.15 | 0.26 | V    |
|   |                           | Q7S; I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V                                  | -    | 0.16 | 0.26 | V    |
|   |                           | Qn; I <sub>O</sub> = 6.0 mA; V <sub>CC</sub> = 4.5 V                                   | -    | 0.15 | 0.26 | V    |
|   |                           | Qn; I <sub>O</sub> = 7.8 mA; V <sub>CC</sub> = 6.0 V                                   | -    | 0.16 | 0.26 | V    |
| I <sub>I</sub>                            | input leakage current     | V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V                       | -    | -    | ±0.1 | µA   |
| I <sub>CC</sub>                           | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 6.0 V | -    | -    | 8.0  | µA   |
| C <sub>i</sub>                            | input capacitance         |  | -    | 3.5  | -    | pF   |
| <b>T<sub>amb</sub> = -40 °C to +85 °C</b> |                           |  |      |      |      |      |
| V <sub>IH</sub>                           | HIGH-level input voltage  | V <sub>CC</sub> = 2.0 V  | 1.5  | -    | -    | V    |
|   |                           | V <sub>CC</sub> = 4.5 V  | 3.15 | -    | -    | V    |
|   |                           | V <sub>CC</sub> = 6.0 V  | 4.2  | -    | -    | V    |
| V <sub>IL</sub>                           | LOW-level input voltage   | V <sub>CC</sub> = 2.0 V  | -    | -    | 0.5  | V    |
|   |                           | V <sub>CC</sub> = 4.5 V  | -    | -    | 1.35 | V    |
|   |                           | V <sub>CC</sub> = 6.0 V  | -    | -    | 1.8  | V    |
| V <sub>OH</sub>                           | HIGH-level output voltage | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                    |      |      |      |      |
|   |                           | Q7S; I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V                                 | 3.84 | -    | -    | V    |
|   |                           | Q7S; I <sub>O</sub> = -5.2 mA; V <sub>CC</sub> = 6.0 V                                 | 5.34 | -    | -    | V    |
|   |                           | Qn; I <sub>O</sub> = -6.0 mA; V <sub>CC</sub> = 4.5 V                                  | 3.84 | -    | -    | V    |
|   |                           | Qn; I <sub>O</sub> = -7.8 mA; V <sub>CC</sub> = 6.0 V                                  | 5.34 | -    | -    | V    |
| V <sub>OL</sub>                           | LOW-level output voltage  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                    |      |      |      |      |
|   |                           | Q7S; I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V                                  | -    | -    | 0.33 | V    |
|   |                           | Q7S; I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V                                  | -    | -    | 0.33 | V    |
|   |                           | Qn; I <sub>O</sub> = 6.0 mA; V <sub>CC</sub> = 4.5 V                                   | -    | -    | 0.33 | V    |
|   |                           | Qn; I <sub>O</sub> = 7.8 mA; V <sub>CC</sub> = 6.0 V                                   | -    | -    | 0.33 | V    |
| I <sub>I</sub>                            | input leakage current     | V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V                       | -    | -    | ±1.0 | µA   |
| I <sub>CC</sub>                           | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 6.0 V | -    | -    | 80   | µA   |

| Symbol                                     | Parameter                 | Conditions   | Min  | Typ | Max  | Unit |
|--|---------------------------|--|------|-----|------|------|
| <b>T<sub>amb</sub> = -40 °C to +125 °C</b> |                           |  |      |     |      |      |
| V <sub>IH</sub>                            | HIGH-level input voltage  | V <sub>CC</sub> = 2.0 V  | 1.5  | -   | -    | V    |
|  |                           | V <sub>CC</sub> = 4.5 V  | 3.15 | -   | -    | V    |
|  |                           | V <sub>CC</sub> = 6.0 V  | 4.2  | -   | -    | V    |
| V <sub>IL</sub>                            | LOW-level input voltage   | V <sub>CC</sub> = 2.0 V  | -    | -   | 0.5  | V    |
|  |                           | V <sub>CC</sub> = 4.5 V  | -    | -   | 1.35 | V    |
|  |                           | V <sub>CC</sub> = 6.0 V  | -    | -   | 1.8  | V    |
| V <sub>OH</sub>                            | HIGH-level output voltage | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                    |      |     |      |      |
|  |                           | Q7S; I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V                                 | 3.7  | -   | -    | V    |
|  |                           | Q7S; I <sub>O</sub> = -5.2 mA; V <sub>CC</sub> = 6.0 V                                 | 5.2  | -   | -    | V    |
|  |                           | Qn; I <sub>O</sub> = -6.0 mA; V <sub>CC</sub> = 4.5 V                                  | 3.7  | -   | -    | V    |
|  |                           | Qn; I <sub>O</sub> = -7.8 mA; V <sub>CC</sub> = 6.0 V                                  | 5.2  | -   | -    | V    |
| V <sub>OL</sub>                            | LOW-level output voltage  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                    |      |     |      |      |
|  |                           | Q7S; I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V                                  | -    | -   | 0.4  | V    |
|  |                           | Q7S; I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V                                  | -    | -   | 0.4  | V    |
|  |                           | Qn; I <sub>O</sub> = 6.0 mA; V <sub>CC</sub> = 4.5 V                                   | -    | -   | 0.4  | V    |
|  |                           | Qn; I <sub>O</sub> = 7.8 mA; V <sub>CC</sub> = 6.0 V                                   | -    | -   | 0.4  | V    |
| I <sub>I</sub>                             | input leakage current     | V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V                       | -    | -   | ±1.0 | µA   |
| I <sub>CC</sub>                            | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 6.0 V | -    | -   | 160  | µA   |

**Table 7. Static characteristics type 74HCT594-Q100**

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

| Symbol                         | Parameter                 | Conditions   | Min  | Typ  | Max  | Unit |
|--------------------------------|---------------------------|--|------|------|------|------|
| <b>T<sub>amb</sub> = 25 °C</b> |                           |  |      |      |      |      |
| V <sub>IH</sub>                | HIGH-level input voltage  | V <sub>CC</sub> = 4.5 V to 5.5 V   | 2.0  | 1.6  | -    | V    |
| V <sub>IL</sub>                | LOW-level input voltage   | V <sub>CC</sub> = 4.5 V to 5.5 V   | -    | 1.2  | 0.8  | V    |
| V <sub>OH</sub>                | HIGH-level output voltage | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |      |      |      |      |
|                                |                           | Q7S; I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V   | 3.98 | 4.32 | -    | V    |
|                                |                           | Qn; I <sub>O</sub> = -6.0 mA; V <sub>CC</sub> = 4.5 V  | 3.98 | 4.32 | -    | V    |
| V <sub>OL</sub>                | LOW-level output voltage  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |      |      |      |      |
|                                |                           | Q7S; I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V  | -    | 0.15 | 0.26 | V    |
|                                |                           | Qn; I <sub>O</sub> = 6.0 mA; V <sub>CC</sub> = 4.5 V   | -    | 0.16 | 0.26 | 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   | -    | -    | ±0.1 | 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   | -    | -    | 8.0  | µA   |
| ΔI <sub>CC</sub>               | additional supply current | per input pin; V <sub>I</sub> = V <sub>CC</sub> - 2.1 V and other inputs at V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 4.5 V to 5.5 V |      |      |      |      |
|                                |                           | pins SHR, SHCP, STCP, STR  | -    | 150  | 540  | µA   |
|                                |                           | pin DS   | -    | 25   | 90   | µA   |
| C <sub>i</sub>                 | input capacitance         |  | -    | 3.5  | -    | pF   |

| Symbol                                     | Parameter                 | Conditions   | Min  | Typ | Max   | Unit |
|--|---------------------------|--|------|-----|-------|------|
| <b>T<sub>amb</sub> = -40 °C to +85 °C</b>  |                           |  |      |     |       |      |
| V <sub>IH</sub>                            | HIGH-level input voltage  | V <sub>CC</sub> = 4.5 V to 5.5 V   | 2.0  | -   | -     | V    |
| V <sub>IL</sub>                            | LOW-level input voltage   | V <sub>CC</sub> = 4.5 V to 5.5 V   | -    | -   | 0.8   | V    |
| V <sub>OH</sub>                            | HIGH-level output voltage | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |      |     |       |      |
|  |                           | Q7S; I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V   | 3.84 | -   | -     | V    |
|  |                           | Qn; I <sub>O</sub> = -6.0 mA; V <sub>CC</sub> = 4.5 V  | 3.84 | -   | -     | V    |
| V <sub>OL</sub>                            | LOW-level output voltage  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |      |     |       |      |
|  |                           | Q7S; I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V  | -    | -   | 0.33  | V    |
|  |                           | Qn; I <sub>O</sub> = 6.0 mA; V <sub>CC</sub> = 4.5 V   | -    | -   | 0.33  | 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   | -    | -   | ±1.0  | 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   | -    | -   | 80    | µA   |
| ΔI <sub>CC</sub>                           | additional supply current | per input pin; V <sub>I</sub> = V <sub>CC</sub> - 2.1 V and other inputs at V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 4.5 V to 5.5 V |      |     |       |      |
|  |                           | pins $\overline{\text{SHR}}$ , SHCP, STCP, STR   | -    | -   | 675   | µA   |
|  |                           | pin DS   | -    | -   | 112.5 | µA   |
| <b>T<sub>amb</sub> = -40 °C to +125 °C</b> |                           |  |      |     |       |      |
| V <sub>IH</sub>                            | HIGH-level input voltage  | V <sub>CC</sub> = 4.5 V to 5.5 V   | 2.0  | -   | -     | V    |
| V <sub>IL</sub>                            | LOW-level input voltage   | V <sub>CC</sub> = 4.5 V to 5.5 V   | -    | -   | 0.8   | V    |
| V <sub>OH</sub>                            | HIGH-level output voltage | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |      |     |       |      |
|  |                           | Q7S; I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V   | 3.7  | -   | -     | V    |
|  |                           | Qn; I <sub>O</sub> = -6.0 mA; V <sub>CC</sub> = 4.5 V  | 3.7  | -   | -     | V    |
| V <sub>OL</sub>                            | LOW-level output voltage  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |      |     |       |      |
|  |                           | Q7S; I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V  | -    | -   | 0.4   | V    |
|  |                           | Qn; I <sub>O</sub> = 6.0 mA; V <sub>CC</sub> = 4.5 V   | -    | -   | 0.4   | 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   | -    | -   | ±1.0  | 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   | -    | -   | 160   | µA   |
| ΔI <sub>CC</sub>                           | additional supply current | per input pin; V <sub>I</sub> = V <sub>CC</sub> - 2.1 V and other inputs at V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 4.5 V to 5.5 V |      |     |       |      |
|  |                           | pins $\overline{\text{SHR}}$ , SHCP, STCP, STR   | -    | -   | 735   | µA   |
|  |                           | pin DS   | -    | -   | 122.5 | µA   |



## 11. Dynamic characteristics

**Table 8. Dynamic characteristics type 74HC594-Q100**

$GND = 0\text{ V}$ ;  $t_r = t_f = 6\text{ ns}$ ;  $C_L = 50\text{ pF}$ ; For test circuit see [Fig. 14](#).

| Symbol                  | Parameter                          | Conditions                                     | 25 °C |     |     | -40 °C to +85 °C |     | -40 °C to +125 °C |     | Unit |
|-------------------------|------------------------------------|--|-------|-----|-----|------------------|-----|-------------------|-----|------|
|                         |                                    |  | Min   | Typ | Max | Min              | Max | Min               | Max |      |
| $t_{pd}$                | propagation delay                  | SHCP to Q7S; see <a href="#">Fig. 8</a> [1]    |       |     |     |                  |     |                   |     |      |
|                         |                                    | $V_{CC} = 2.0\text{ V}$                        | -     | 44  | 150 | -                | 185 | -                 | 225 | ns   |
|                         |                                    | $V_{CC} = 4.5\text{ V}$                        | -     | 16  | 30  | -                | 37  | -                 | 45  | ns   |
|                         |                                    | $V_{CC} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$ | -     | 13  | -   | -                | -   | -                 | -   | ns   |
|                         |                                    | $V_{CC} = 6.0\text{ V}$                        | -     | 14  | 26  | -                | 31  | -                 | 38  | ns   |
|                         |                                    | STCP to Qn; see <a href="#">Fig. 9</a>         |       |     |     |                  |     |                   |     |      |
|                         |                                    | $V_{CC} = 2.0\text{ V}$                        | -     | 44  | 150 | -                | 185 | -                 | 225 | ns   |
|                         |                                    | $V_{CC} = 4.5\text{ V}$                        | -     | 16  | 30  | -                | 37  | -                 | 45  | ns   |
|                         |                                    | $V_{CC} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$ | -     | 13  | -   | -                | -   | -                 | -   | ns   |
| $V_{CC} = 6.0\text{ V}$ | -                                  | 14   | 26    | -   | 31  | -                | 38  | ns                |     |      |
| $t_{PHL}$               | HIGH to LOW propagation delay      | SHR to Q7S; see <a href="#">Fig. 12</a>        |       |     |     |                  |     |                   |     |      |
|                         |                                    | $V_{CC} = 2.0\text{ V}$                        | -     | 39  | 150 | -                | 185 | -                 | 225 | ns   |
|                         |                                    | $V_{CC} = 4.5\text{ V}$                        | -     | 14  | 30  | -                | 37  | -                 | 45  | ns   |
|                         |                                    | $V_{CC} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$ | -     | 11  | -   | -                | -   | -                 | -   | ns   |
|                         |                                    | $V_{CC} = 6.0\text{ V}$                        | -     | 12  | 26  | -                | 31  | -                 | 38  | ns   |
|                         |                                    | STR to Qn; see <a href="#">Fig. 13</a>         |       |     |     |                  |     |                   |     |      |
|                         |                                    | $V_{CC} = 2.0\text{ V}$                        | -     | 39  | 125 | -                | 155 | -                 | 185 | ns   |
|                         |                                    | $V_{CC} = 4.5\text{ V}$                        | -     | 14  | 25  | -                | 31  | -                 | 37  | ns   |
|                         |                                    | $V_{CC} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$ | -     | 11  | -   | -                | -   | -                 | -   | ns   |
| $V_{CC} = 6.0\text{ V}$ | -                                  | 12   | 21    | -   | 26  | -                | 31  | ns                |     |      |
| $t_{THL}$               | HIGH to LOW output transition time | Q7S; see <a href="#">Fig. 8</a>                |       |     |     |                  |     |                   |     |      |
|                         |                                    | $V_{CC} = 2.0\text{ V}$                        | -     | 19  | 75  | -                | 95  | -                 | 110 | ns   |
|                         |                                    | $V_{CC} = 4.5\text{ V}$                        | -     | 7   | 15  | -                | 19  | -                 | 22  | ns   |
|                         |                                    | $V_{CC} = 6.0\text{ V}$                        | -     | 6   | 13  | -                | 16  | -                 | 19  | ns   |
|                         |                                    | Qn   |       |     |     |                  |     |                   |     |      |
|                         |                                    | $V_{CC} = 2.0\text{ V}$                        | -     | 14  | 60  | -                | 75  | -                 | 90  | ns   |
|                         |                                    | $V_{CC} = 4.5\text{ V}$                        | -     | 5   | 12  | -                | 15  | -                 | 18  | ns   |
|                         |                                    | $V_{CC} = 6.0\text{ V}$                        | -     | 4   | 10  | -                | 13  | -                 | 15  | ns   |
| $t_{TLH}$               | LOW to HIGH output transition time | Q7S; see <a href="#">Fig. 8</a>                |       |     |     |                  |     |                   |     |      |
|                         |                                    | $V_{CC} = 2.0\text{ V}$                        | -     | 19  | 75  | -                | 95  | -                 | 110 | ns   |
|                         |                                    | $V_{CC} = 4.5\text{ V}$                        | -     | 7   | 15  | -                | 19  | -                 | 22  | ns   |
|                         |                                    | $V_{CC} = 6.0\text{ V}$                        | -     | 6   | 13  | -                | 16  | -                 | 19  | ns   |
|                         |                                    | Qn   |       |     |     |                  |     |                   |     |      |
|                         |                                    | $V_{CC} = 2.0\text{ V}$                        | -     | 14  | 60  | -                | 75  | -                 | 90  | ns   |
|                         |                                    | $V_{CC} = 4.5\text{ V}$                        | -     | 5   | 12  | -                | 15  | -                 | 18  | ns   |
|                         |                                    | $V_{CC} = 6.0\text{ V}$                        | -     | 4   | 10  | -                | 13  | -                 | 15  | ns   |

| Symbol    | Parameter     | Conditions   | 25 °C |     |     | -40 °C to +85 °C |     | -40 °C to +125 °C |     | Unit |
|-----------|---------------|--|-------|-----|-----|------------------|-----|-------------------|-----|------|
|           |               |  | Min   | Typ | Max | Min              | Max | Min               | Max |      |
| $t_w$     | pulse width   | SHCP (HIGH or LOW);<br>see <a href="#">Fig. 8</a>  |       |     |     |                  |     |                   |     |      |
|           |               | $V_{CC} = 2.0\text{ V}$  | 80    | 10  | -   | 100              | -   | 120               | -   | ns   |
|           |               | $V_{CC} = 4.5\text{ V}$  | 16    | 4   | -   | 20               | -   | 24                | -   | ns   |
|           |               | $V_{CC} = 6.0\text{ V}$  | 14    | 3   | -   | 17               | -   | 20                | -   | ns   |
|           |               | STCP (HIGH or LOW);<br>see <a href="#">Fig. 9</a>  |       |     |     |                  |     |                   |     |      |
|           |               | $V_{CC} = 2.0\text{ V}$  | 80    | 10  | -   | 100              | -   | 120               | -   | ns   |
|           |               | $V_{CC} = 4.5\text{ V}$  | 16    | 4   | -   | 20               | -   | 24                | -   | ns   |
|           |               | $V_{CC} = 6.0\text{ V}$  | 14    | 3   | -   | 17               | -   | 20                | -   | ns   |
|           |               | SHR and STR<br>(HIGH or LOW); see <a href="#">Fig. 12</a><br>and <a href="#">Fig. 13</a>   |       |     |     |                  |     |                   |     |      |
|           |               | $V_{CC} = 2.0\text{ V}$  | 80    | 14  | -   | 100              | -   | 120               | -   | ns   |
|           |               | $V_{CC} = 4.5\text{ V}$  | 16    | 5   | -   | 20               | -   | 24                | -   | ns   |
|           |               | $V_{CC} = 6.0\text{ V}$  | 14    | 4   | -   | 17               | -   | 20                | -   | ns   |
| $t_{su}$  | set-up time   | DS to SHCP; see <a href="#">Fig. 10</a>  |       |     |     |                  |     |                   |     |      |
|           |               | $V_{CC} = 2.0\text{ V}$  | 100   | 10  | -   | 125              | -   | 150               | -   | ns   |
|           |               | $V_{CC} = 4.5\text{ V}$  | 20    | 4   | -   | 25               | -   | 30                | -   | ns   |
|           |               | $V_{CC} = 6.0\text{ V}$  | 17    | 3   | -   | 21               | -   | 26                | -   | ns   |
|           |               | SHR to STCP; see <a href="#">Fig. 11</a>   |       |     |     |                  |     |                   |     |      |
|           |               | $V_{CC} = 2.0\text{ V}$  | 100   | 14  | -   | 125              | -   | 150               | -   | ns   |
|           |               | $V_{CC} = 4.5\text{ V}$  | 20    | 5   | -   | 25               | -   | 30                | -   | ns   |
|           |               | $V_{CC} = 6.0\text{ V}$  | 17    | 4   | -   | 21               | -   | 26                | -   | ns   |
|           |               | SHCP to STCP; see <a href="#">Fig. 9</a>   |       |     |     |                  |     |                   |     |      |
|           |               | $V_{CC} = 2.0\text{ V}$  | 100   | 17  | -   | 125              | -   | 150               | -   | ns   |
|           |               | $V_{CC} = 4.5\text{ V}$  | 20    | 6   | -   | 25               | -   | 30                | -   | ns   |
|           |               | $V_{CC} = 6.0\text{ V}$  | 17    | 5   | -   | 21               | -   | 26                | -   | ns   |
| $t_h$     | hold time     | DS to SHCP; see <a href="#">Fig. 10</a>  |       |     |     |                  |     |                   |     |      |
|           |               | $V_{CC} = 2.0\text{ V}$  | 25    | -8  | -   | 30               | -   | 35                | -   | ns   |
|           |               | $V_{CC} = 4.5\text{ V}$  | 5     | -3  | -   | 6                | -   | 7                 | -   | ns   |
|           |               | $V_{CC} = 6.0\text{ V}$  | 4     | -2  | -   | 5                | -   | 6                 | -   | ns   |
| $t_{rec}$ | recovery time | SHR to SHCP and<br>STR to STCP; see <a href="#">Fig. 12</a><br>and <a href="#">Fig. 13</a> |       |     |     |                  |     |                   |     |      |
|           |               | $V_{CC} = 2.0\text{ V}$  | 50    | -14 | -   | 65               | -   | 75                | -   | ns   |
|           |               | $V_{CC} = 4.5\text{ V}$  | 10    | -5  | -   | 13               | -   | 15                | -   | ns   |
|           |               | $V_{CC} = 6.0\text{ V}$  | 9     | -4  | -   | 11               | -   | 13                | -   | ns   |

| Symbol           | Parameter                     | Conditions   | 25 °C |     |     | -40 °C to +85 °C |     | -40 °C to +125 °C |     | Unit |
|------------------|-------------------------------|--|-------|-----|-----|------------------|-----|-------------------|-----|------|
|                  |                               |  | Min   | Typ | Max | Min              | Max | Min               | Max |      |
| f <sub>max</sub> | maximum frequency             | SHCP or STCP; see Fig. 8 and Fig. 9  |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 2.0 V  | 6.0   | 30  | -   | 4.8              | -   | 4.0               | -   | MHz  |
|                  |                               | V <sub>CC</sub> = 4.5 V  | 30    | 92  | -   | 24               | -   | 20                | -   | MHz  |
|                  |                               | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF  | -     | 100 | -   | -                | -   | -                 | -   | MHz  |
|                  |                               | V <sub>CC</sub> = 6.0 V  | 35    | 109 | -   | 28               | -   | 24                | -   | MHz  |
| C <sub>PD</sub>  | power dissipation capacitance | V <sub>I</sub> = GND to V <sub>CC</sub> ; V <sub>CC</sub> = 5 V; [2]<br>f <sub>i</sub> = 1 MHz | -     | 84  | -   | -                | -   | -                 | -   | pF   |

[1] t<sub>pd</sub> is the same as t<sub>PHL</sub> and t<sub>PLH</sub>.

[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 outputs.

**Table 9. Dynamic characteristics type 74HCT594-Q100**

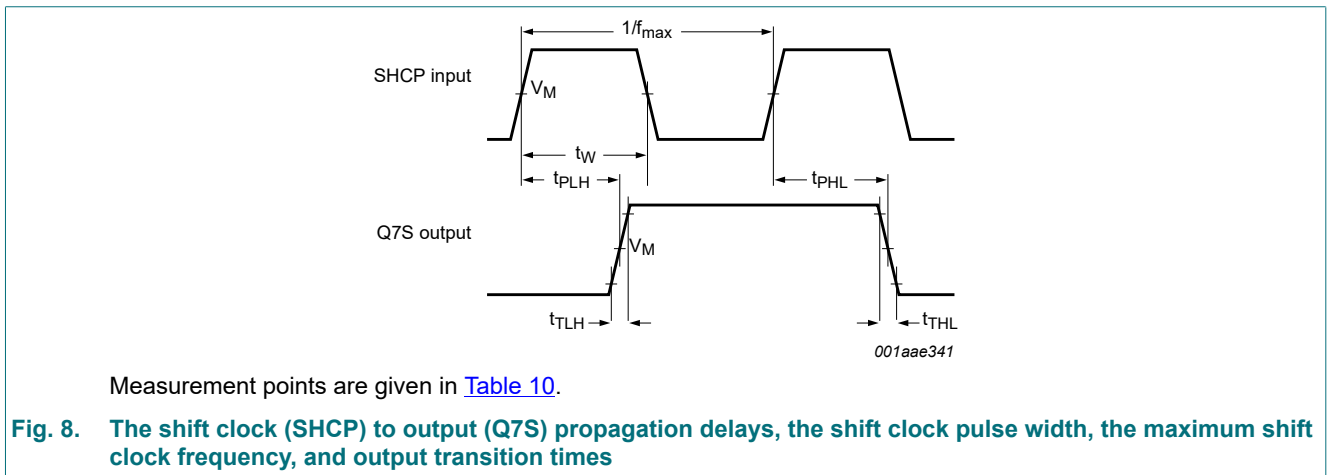
GND = 0 V; V<sub>CC</sub> = 4.5 V; t<sub>r</sub> = t<sub>f</sub> = 6 ns; C<sub>L</sub> = 50 pF; For test circuit see Fig. 14.

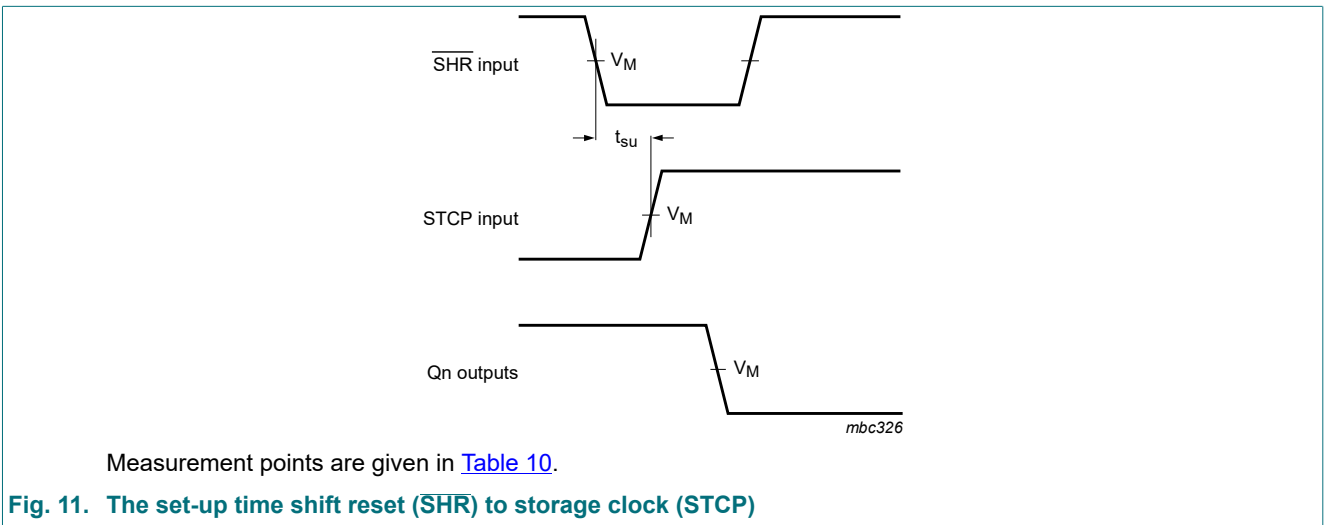
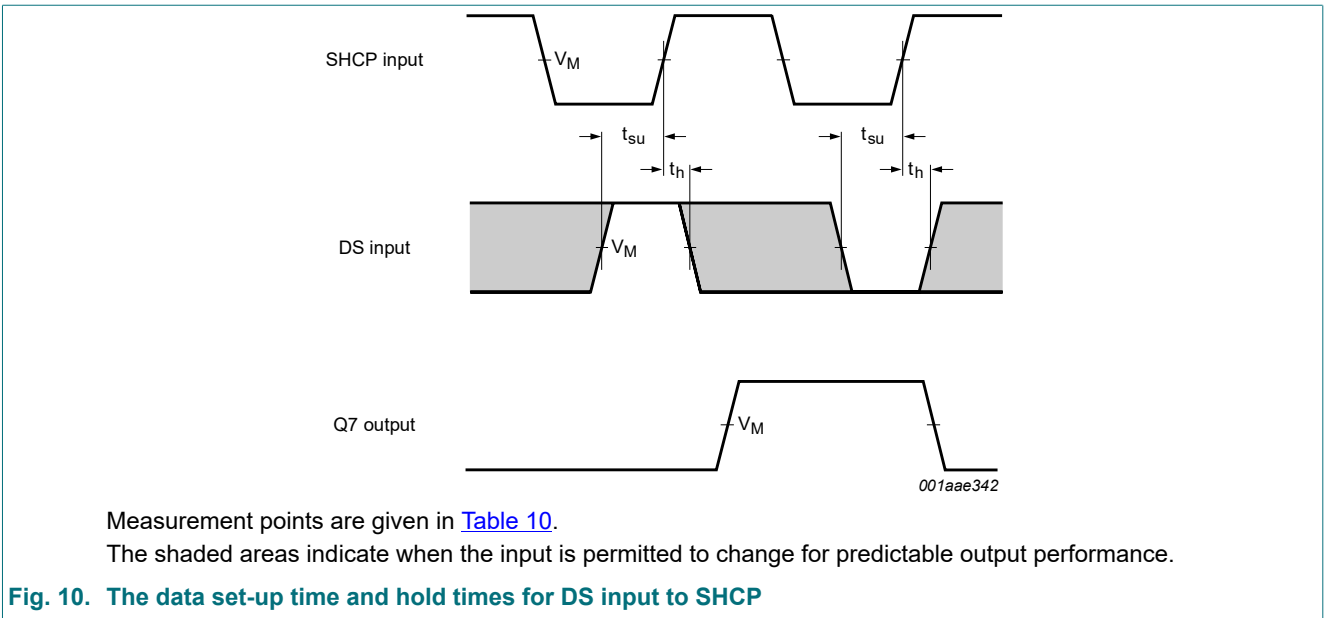
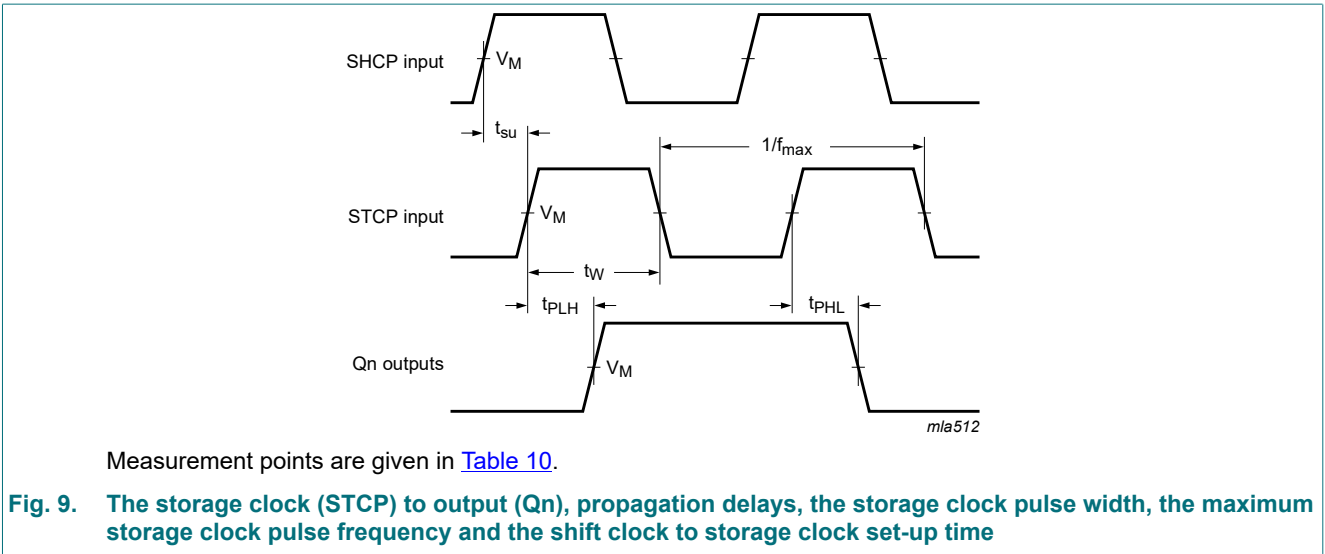
| Symbol           | Parameter                          | Conditions   | 25 °C |     |     | -40 °C to +85 °C |     | -40 °C to +125 °C |     | Unit |
|------------------|------------------------------------|--|-------|-----|-----|------------------|-----|-------------------|-----|------|
|                  |                                    |  | Min   | Typ | Max | Min              | Max | Min               | Max |      |
| t <sub>pd</sub>  | propagation delay                  | SHCP to Q7S; see Fig. 8 [1]                        | -     | 18  | 32  | -                | 40  | -                 | 48  | ns   |
|                  |                                    | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF    | -     | 15  | -   | -                | -   | -                 | -   | ns   |
|                  |                                    | STCP to Qn; see Fig. 9                             | -     | 18  | 32  | -                | 40  | -                 | 48  | ns   |
|                  |                                    | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF    | -     | 15  | -   | -                | -   | -                 | -   | ns   |
| t <sub>PHL</sub> | HIGH to LOW propagation delay      | SHR to Q7S; see Fig. 12                            | -     | 17  | 30  | -                | 38  | -                 | 45  | ns   |
|                  |                                    | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF    | -     | 14  | -   | -                | -   | -                 | -   | ns   |
|                  |                                    | STR to Qn; see Fig. 13                             | -     | 17  | 30  | -                | 38  | -                 | 45  | ns   |
|                  |                                    | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF    | -     | 14  | -   | -                | -   | -                 | -   | ns   |
| t <sub>THL</sub> | HIGH to LOW output transition time | Q7S; see Fig. 8                                    |       |     |     |                  |     |                   |     |      |
|                  |                                    | V <sub>CC</sub> = 4.5 V                            | -     | 7   | 15  | -                | 19  | -                 | 22  | ns   |
|                  |                                    | Qn   |       |     |     |                  |     |                   |     |      |
| t <sub>TLH</sub> | LOW to HIGH output transition time | V <sub>CC</sub> = 4.5 V                            | -     | 7   | 15  | -                | 19  | -                 | 22  | ns   |
|                  |                                    | Qn   |       |     |     |                  |     |                   |     |      |
|                  |                                    | V <sub>CC</sub> = 4.5 V                            | -     | 5   | 12  | -                | 15  | -                 | 18  | ns   |
| t <sub>w</sub>   | pulse width                        | SHCP (HIGH or LOW); see Fig. 8                     | 16    | 4   | -   | 20               | -   | 24                | -   | ns   |
|                  |                                    | STCP (HIGH or LOW); see Fig. 9                     | 16    | 4   | -   | 20               | -   | 24                | -   | ns   |
|                  |                                    | SHR and STR (HIGH or LOW); see Fig. 12 and Fig. 13 | 16    | 6   | -   | 20               | -   | 24                | -   | ns   |

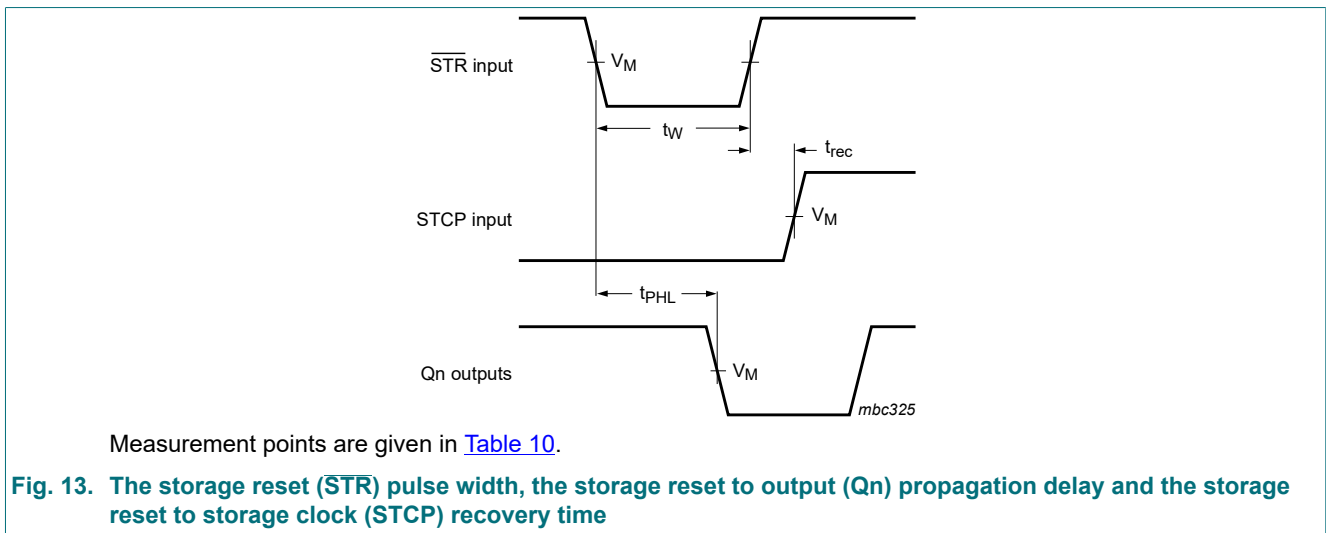
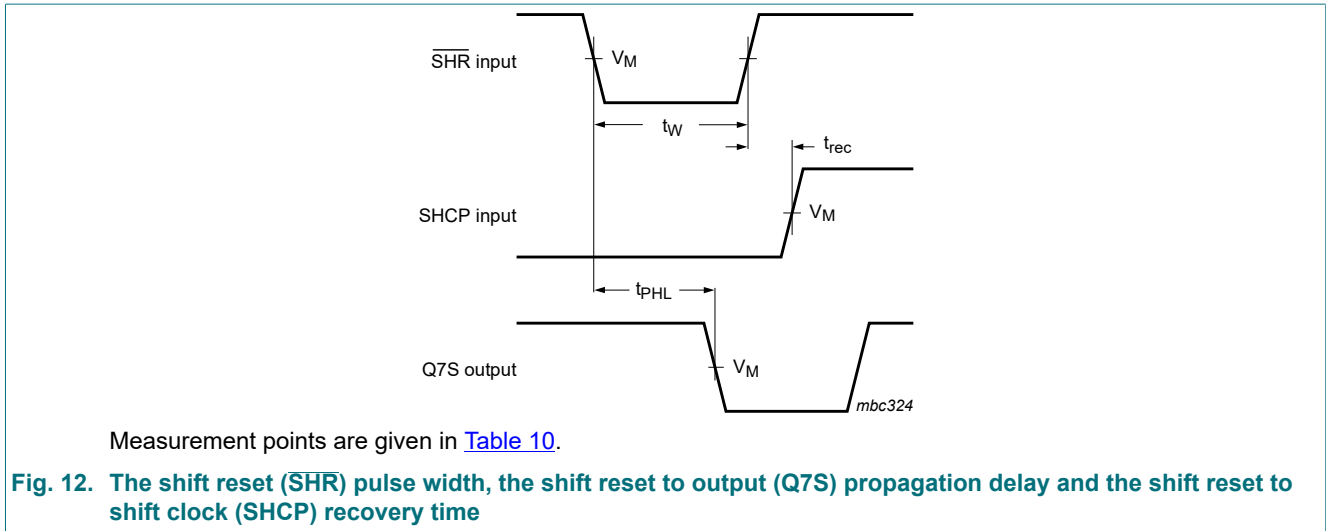
| Symbol           | Parameter                     | Conditions   | 25 °C |     |     | -40 °C to +85 °C |     | -40 °C to +125 °C |     | Unit |
|------------------|-------------------------------|--|-------|-----|-----|------------------|-----|-------------------|-----|------|
|                  |                               |  | Min   | Typ | Max | Min              | Max | Min               | Max |      |
| t <sub>su</sub>  | set-up time                   | DS to SHCP; see Fig. 10  | 20    | 4   | -   | 25               | -   | 30                | -   | ns   |
|                  |                               | SHR to STCP; see Fig. 11   | 20    | 6   | -   | 25               | -   | 30                | -   | ns   |
|                  |                               | SHCP to STCP; see Fig. 9   | 20    | 7   | -   | 25               | -   | 30                | -   | ns   |
| t <sub>h</sub>   | hold time                     | DS to SHCP; see Fig. 10  | 5     | -3  | -   | 6                | -   | 7                 | -   | ns   |
| t <sub>rec</sub> | recovery time                 | SHR to SHCP and STR to STCP; see Fig. 12 and Fig. 13   | 10    | -5  | -   | 13               | -   | 15                | -   | ns   |
| f <sub>max</sub> | maximum frequency             | SHCP or STCP; see Fig. 8 and Fig. 9  | 30    | 92  | -   | 24               | -   | 20                | -   | MHz  |
|                  |                               | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF  | -     | 100 | -   | -                | -   | -                 | -   | MHz  |
| C <sub>PD</sub>  | power dissipation capacitance | V <sub>I</sub> = GND to V <sub>CC</sub> - 1.5 V; V <sub>CC</sub> = 5 V; f <sub>i</sub> = 1 MHz [2] | -     | 89  | -   | -                | -   | -                 | -   | pF   |

- [1] t<sub>pd</sub> is the same as t<sub>PHL</sub> and t<sub>PLH</sub>.
- [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;  
 $\sum(C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.

### 11.1. Waveforms and test circuit







**Table 10. Measurement points**

| Type          | Input               | Output              |
|---------------|---------------------|---------------------|
|               | $V_M$               | $V_M$               |
| 74HC594-Q100  | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |
| 74HCT594-Q100 | 1.3 V               | 1.3 V               |

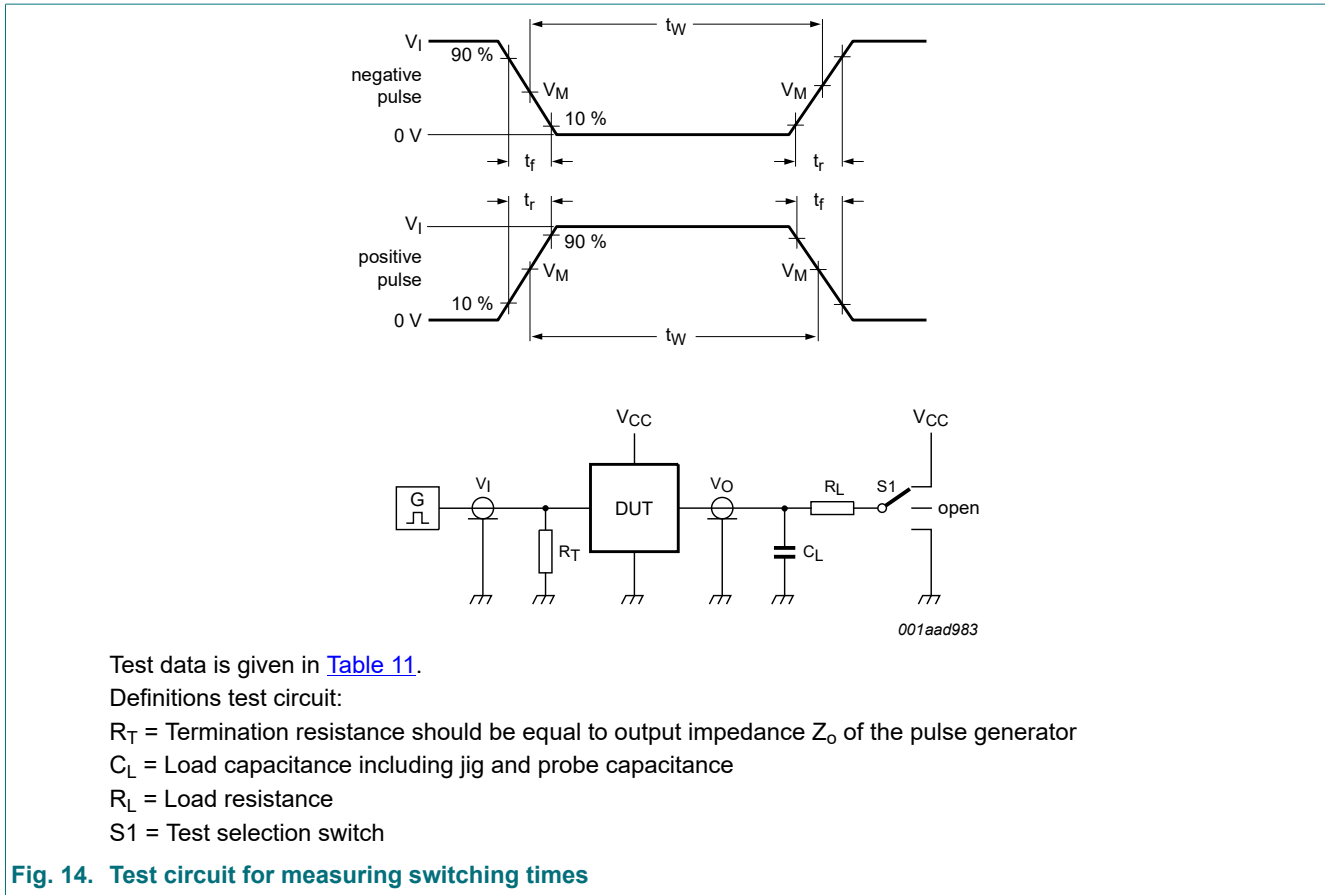


Table 11. Test data

| Type          | Input    |            | Load         |              | S1 position        |                    |                    |
|---------------|----------|------------|--------------|--------------|--------------------|--------------------|--------------------|
|               | $V_I$    | $t_r, t_f$ | $C_L$        | $R_L$        | $t_{PHL}, t_{PLH}$ | $t_{PZH}, t_{PHZ}$ | $t_{PZL}, t_{PLZ}$ |
| 74HC594-Q100  | $V_{CC}$ | 6 ns       | 15 pF, 50 pF | 1 k $\Omega$ | open               | GND                | $V_{CC}$           |
| 74HCT594-Q100 | 3 V      | 6 ns       | 15 pF, 50 pF | 1 k $\Omega$ | open               | GND                | $V_{CC}$           |

## 12. Package outline

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

SOT109-1

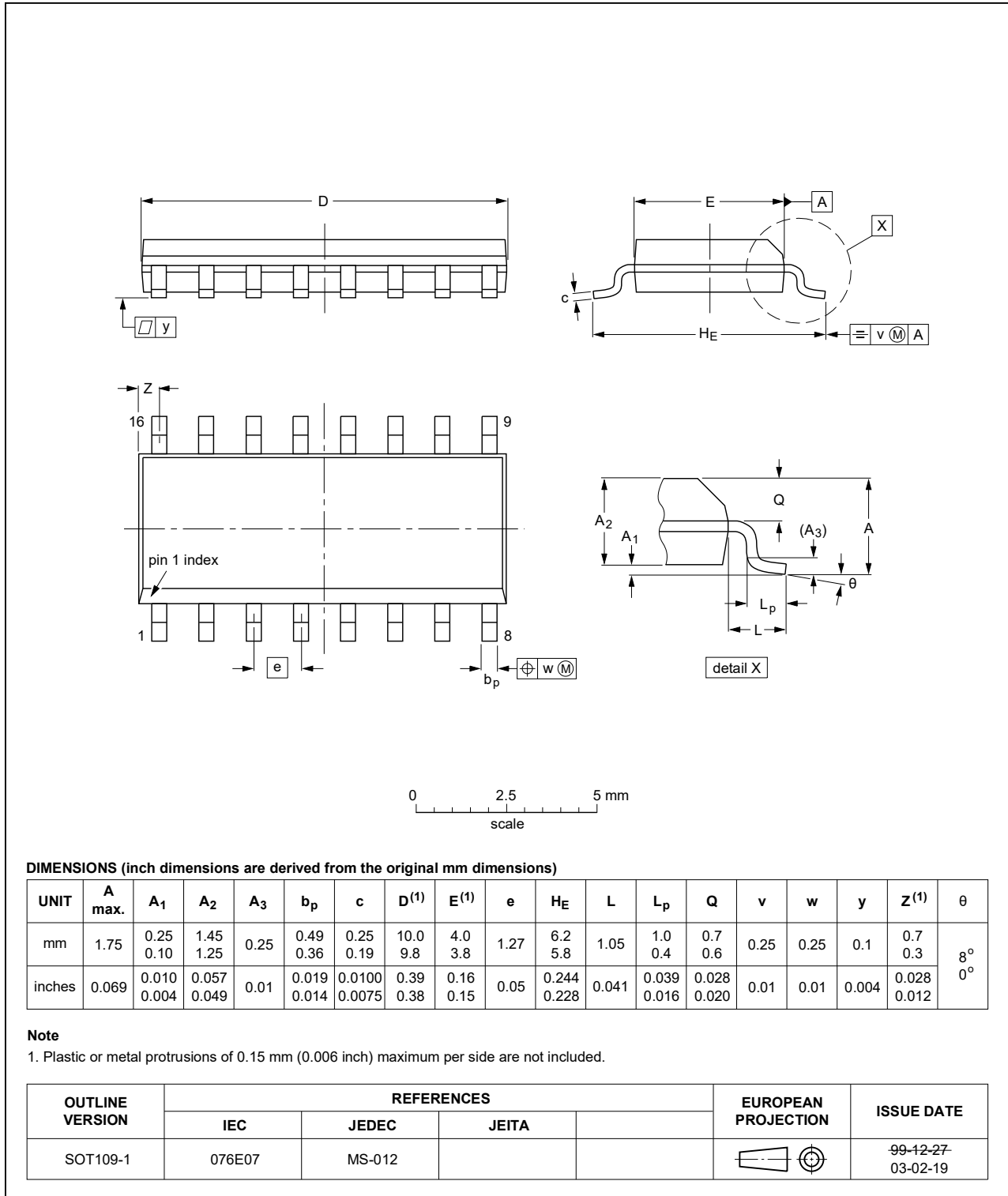


Fig. 15. Package outline SOT109-1 (SO16)



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

SOT403-1

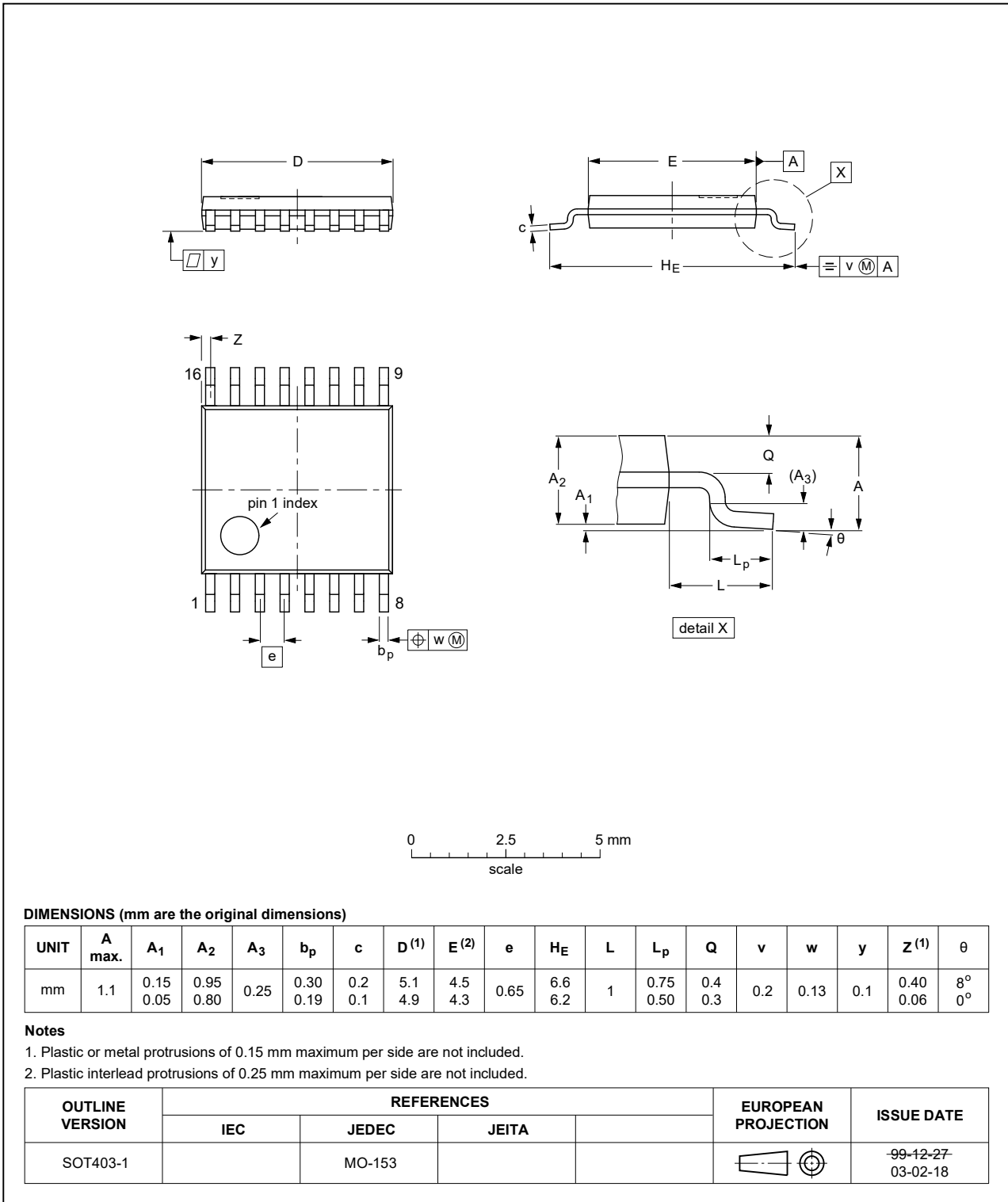


Fig. 16. Package outline SOT403-1 (TSSOP16)

## 13. Abbreviations

Table 12. Abbreviations

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

## 14. Revision history

Table 13. Revision history

| Document ID          | Release date   | Data sheet status  | Change notice | Supersedes           |
|----------------------|--|--------------------|---------------|----------------------|
| 74HC_HCT594_Q100 v.3 | 20210812   | Product data sheet | -             | 74HC_HCT594_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><a href="#">Section 1</a> and <a href="#">Section 2</a> updated.</li> <li><a href="#">Section 8</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li> <li><a href="#">Section 9</a>: rise time and fall time replaced by input transition rise and fall rate.</li> </ul> |                    |               |                      |
| 74HC_HCT594_Q100 v.2 | 20160613   | Product data sheet | -             | 74HC_HCT594_Q100 v.1 |
| Modifications:       | <ul style="list-style-type: none"> <li>Added type number 74HC594PW-Q100 (SOT403-1).</li> </ul>   |                    |               |                      |
| 74HC_HCT594_Q100 v.1 | 20120802   | 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".
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