

# 74AHC594; 74AHCT594

## 8-bit shift register with output register

Rev. 3 — 25 June 2020

Product data sheet

## 1. General description

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The 74AHC594; 74AHCT594 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; 74AHCT594 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 ( $\overline{\text{SHR}}$  and  $\overline{\text{STR}}$ ) 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.

## 2. Features and benefits

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- 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: CMOS level
  - For 74AHCT594: TTL level
- ESD protection:
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V
  - CDM JESD22-C101E exceeds 1000 V
- Multiple package options
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

## 3. Applications

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- 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   | -40 °C to +125 °C | SO16     | plastic small outline package; 16 leads; body width 3.9 mm   | SOT109-1 |
| 74AHCT594D  |                   |          |  |          |
| 74AHC594DB  | -40 °C to +125 °C | SSOP16   | plastic shrink small outline package; 16 leads; body width 5.3 mm  | SOT338-1 |
| 74AHCT594DB |                   |          |  |          |
| 74AHC594PW  | -40 °C to +125 °C | TSSOP16  | plastic thin shrink small outline package; 16 leads; body width 4.4 mm   | SOT403-1 |
| 74AHCT594PW |                   |          |  |          |
| 74AHC594BQ  | -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 |                   |          |  |          |

### 5. Functional diagram

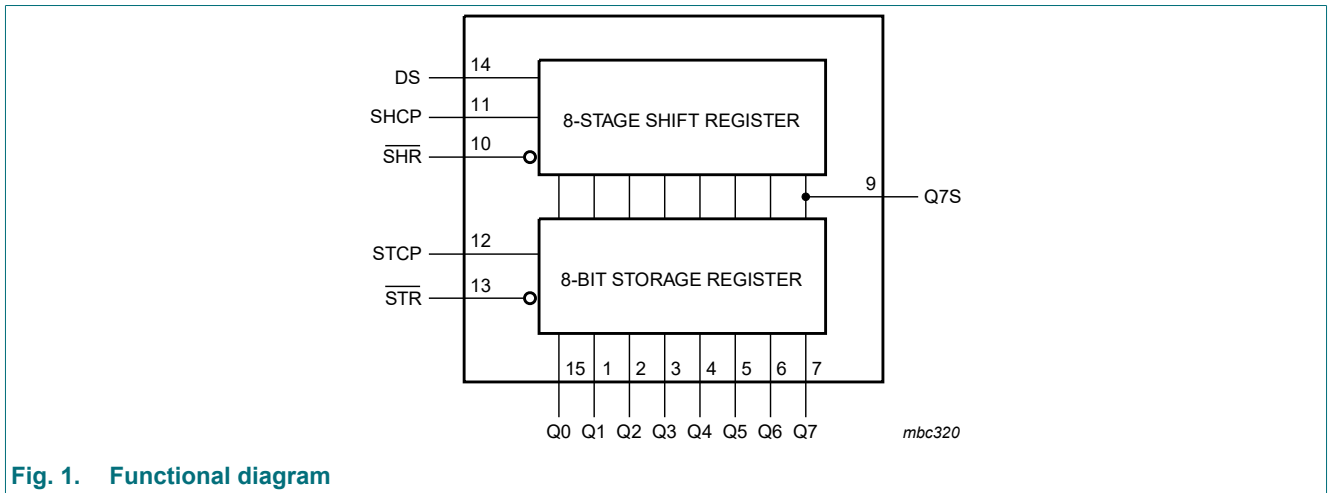


Fig. 1. Functional diagram

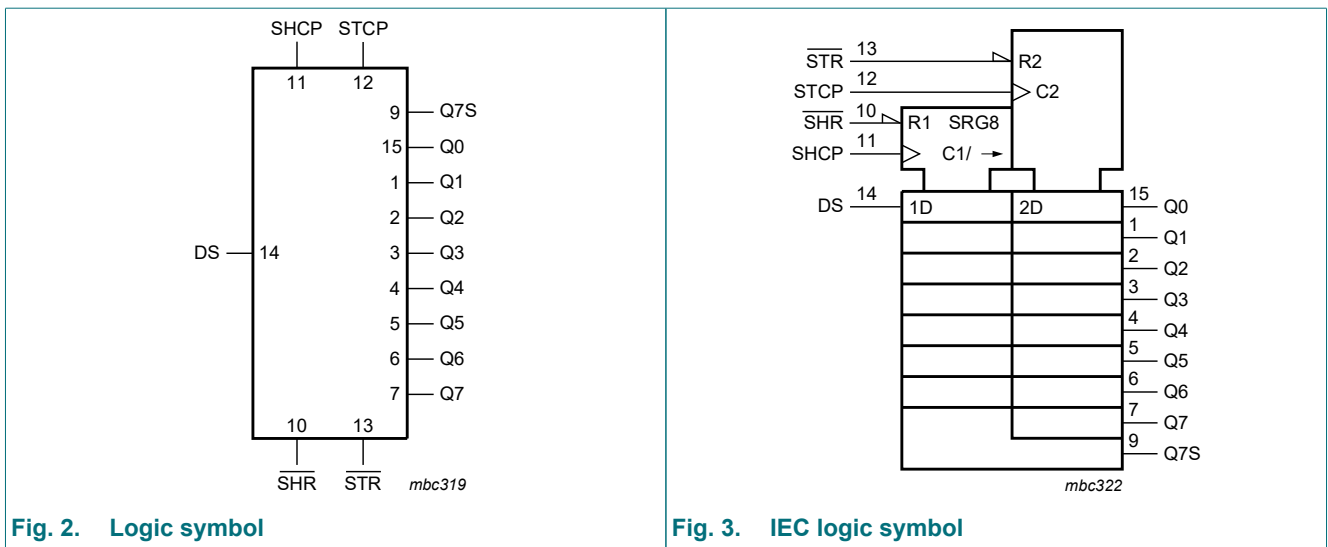


Fig. 2. Logic symbol

Fig. 3. IEC logic symbol

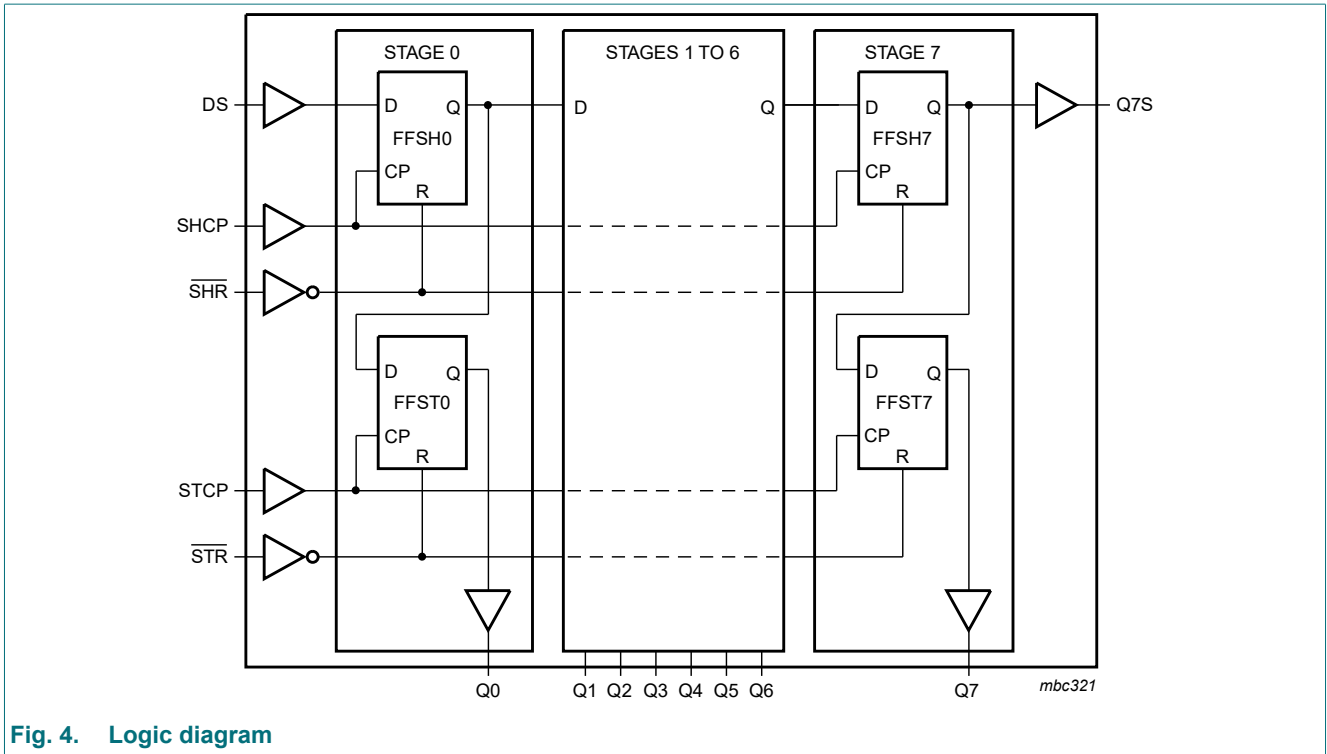


Fig. 4. Logic diagram

## 6. Pinning information

### 6.1. Pinning



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

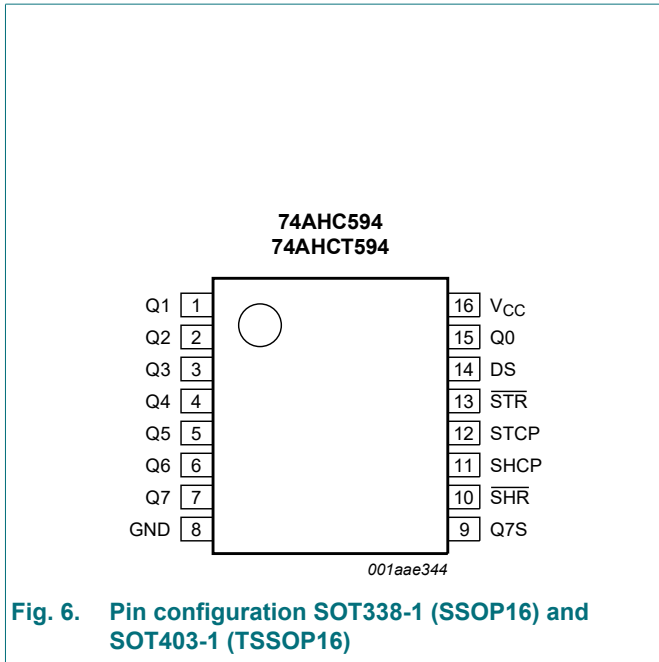


Fig. 6. Pin configuration SOT338-1 (SSOP16) and SOT403-1 (TSSOP16)

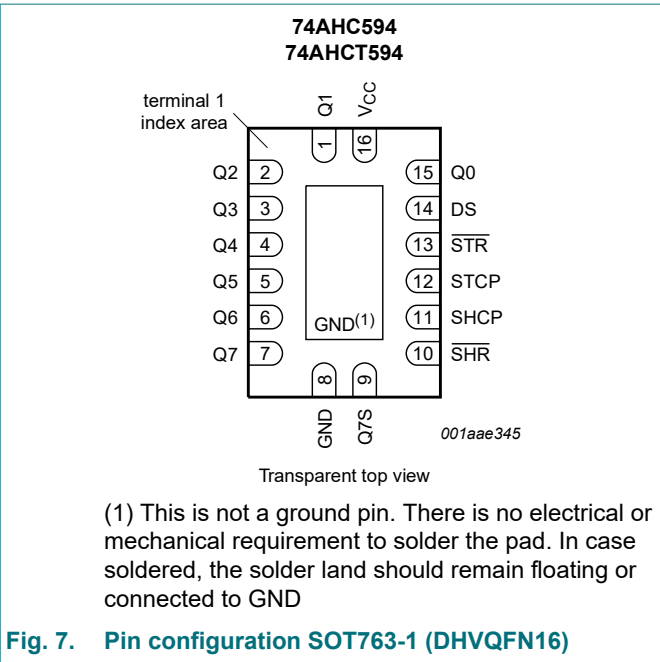


Fig. 7. Pin configuration SOT763-1 (DHVQFN16)

### 6.2. Pin description

Table 2. Pin description

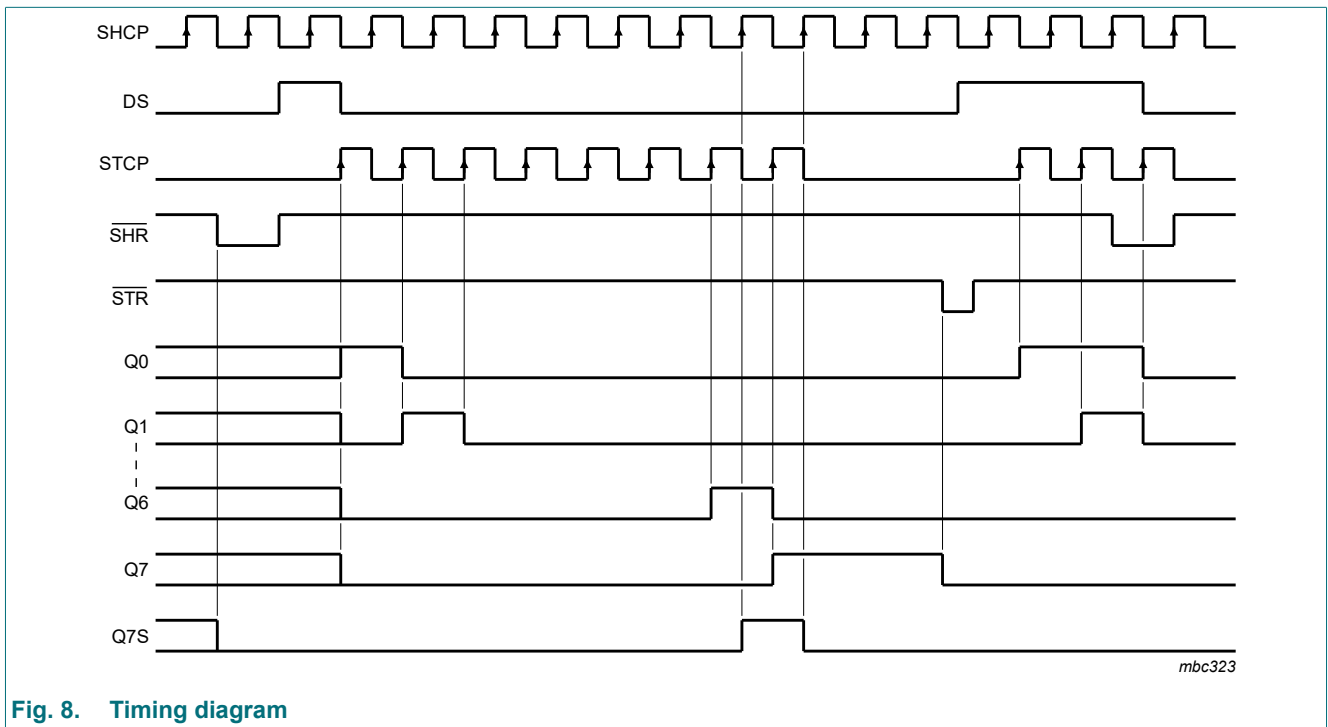
| Symbol                         | Pin                     | Description                               |
|--------------------------------|-------------------------|---|
| Q0, Q1, Q2, Q3, Q4, Q5, Q6, Q7 | 15, 1, 2, 3, 4, 5, 6, 7 | parallel data output                      |
| GND                            | 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 SOT338-1 (SSOP16) package:  $P_{tot}$  derates linearly with 8.5 mW/K above 91 °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 |     |          | 74AHCT594 |     |          | 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</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    |
| 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>I</sub>  | input leakage current     | V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V                          | -     | -   | 0.1  | -                | 1.0  | -                 | 2.0  | μA   |
|                 |                           | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; 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</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; V <sub>I</sub> = V <sub>CC</sub> - 2.1 V;<br>other pins at V <sub>CC</sub> or GND;<br>I <sub>O</sub> = 0 A; 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</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 <a href="#">Fig. 11</a>                              |       |        |      |                  |      |                   |      |      |
|   |                               | 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 <a href="#">Fig. 14</a>                             |       |        |      |                  |      |                   |      |      |
|   |                               | 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 <a href="#">Fig. 10</a>                            |       |        |      |                  |      |                   |      |      |
|   |                               | 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 <a href="#">Fig. 11</a>                              |       |        |      |                  |      |                   |      |      |
|   |                               | 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 <a href="#">Fig. 13</a>                             |       |        |      |                  |      |                   |      |      |
|   |                               | 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 <a href="#">Fig. 12</a>                             |       |        |      |                  |      |                   |      |      |
|   |                               | 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; 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 <a href="#">Fig. 9</a>                              |       |        |      |                  |      |                   |      |      |
|   |                               | 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 <a href="#">Fig. 10</a>                              |       |        |      |                  |      |                   |      |      |
|   |                               | 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 <a href="#">Fig. 9</a>                              |       |        |      |                  |      |                   |      |      |
|   |                               | 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 <a href="#">Fig. 10</a>                              |       |        |      |                  |      |                   |      |      |
|   |                               | 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 <a href="#">Fig. 13</a>                              |       |        |      |                  |      |                   |      |      |
|   |                               | 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 <a href="#">Fig. 12</a>            |                               |  |       |        |      |                  |      |                   |      |      |
| 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 <a href="#">Fig. 9</a> and <a href="#">Fig. 10</a> | 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;

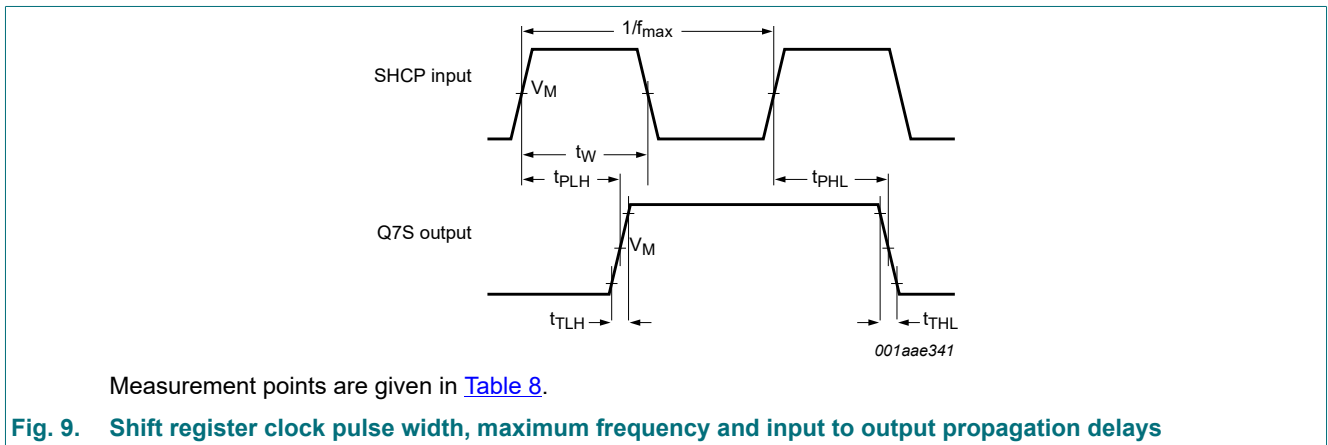
C<sub>L</sub> = output load capacitance in pF;

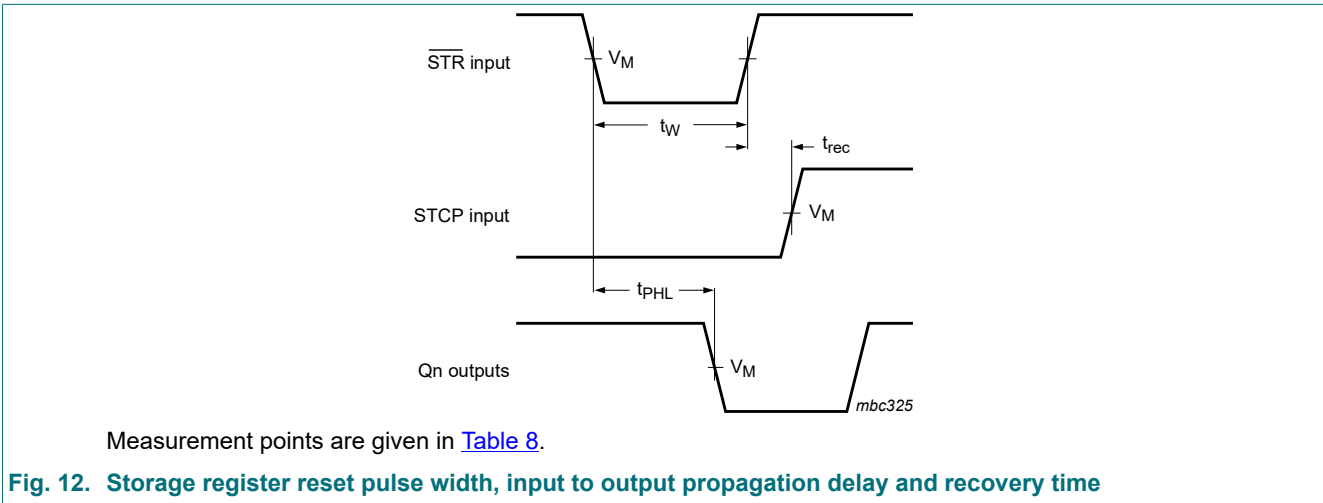
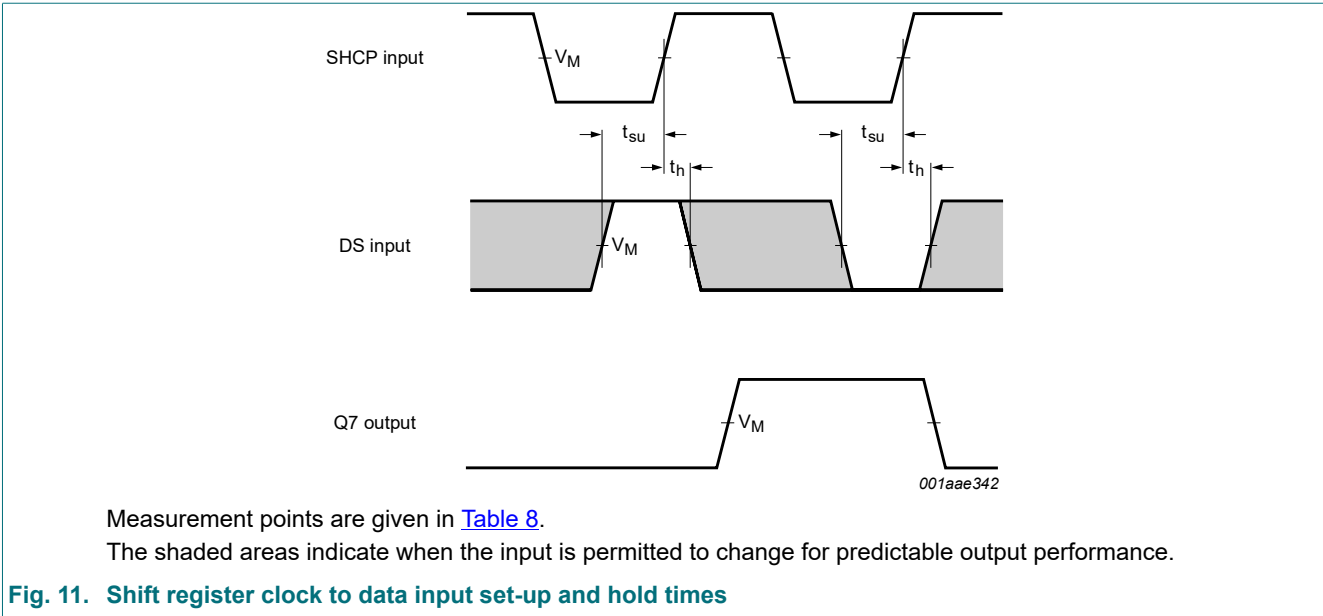
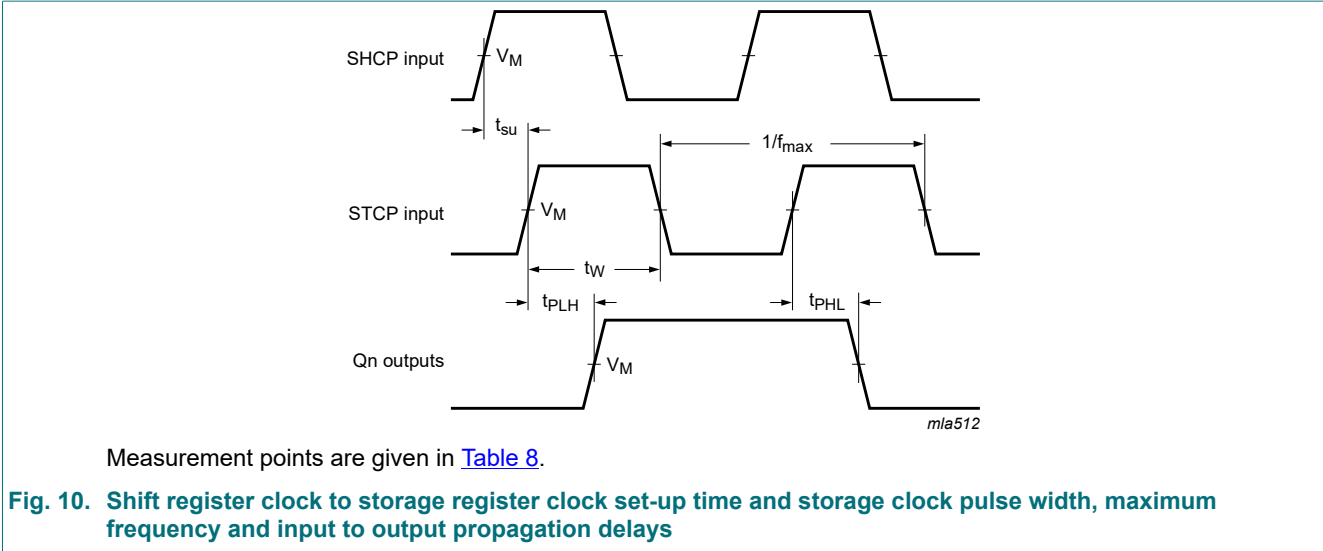
V<sub>CC</sub> = supply voltage in V;

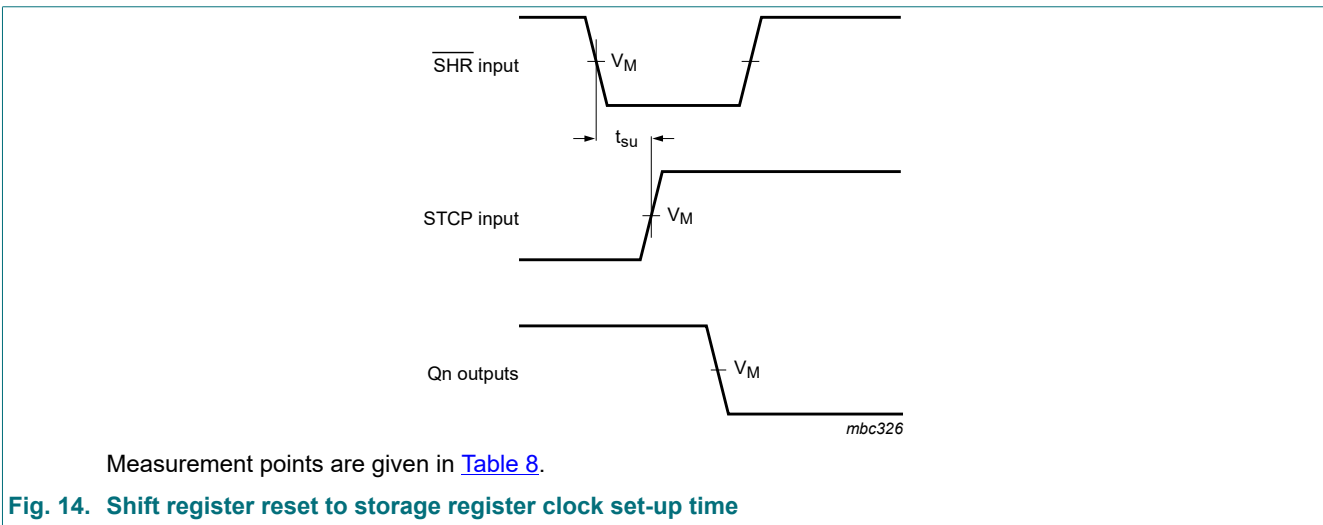
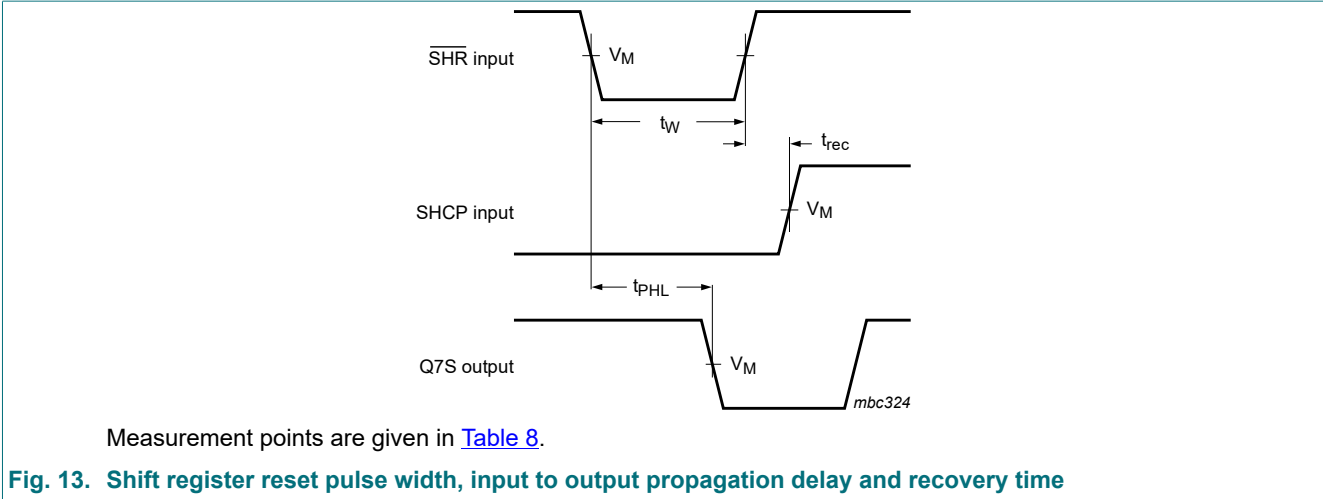
N = number of inputs switching;

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

### 11.1. Waveforms

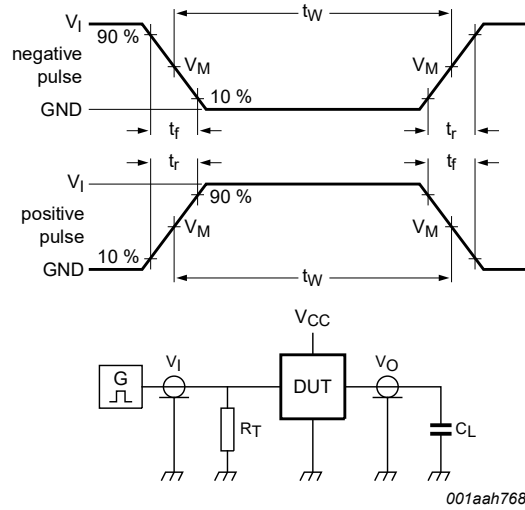






**Table 8. Measurement points**

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



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  | $V_{CC}$ | $\leq 3.0$ ns | 15 pF, 50 pF | $t_{PLH}, t_{PHL}$ |
| 74AHCT594 | 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

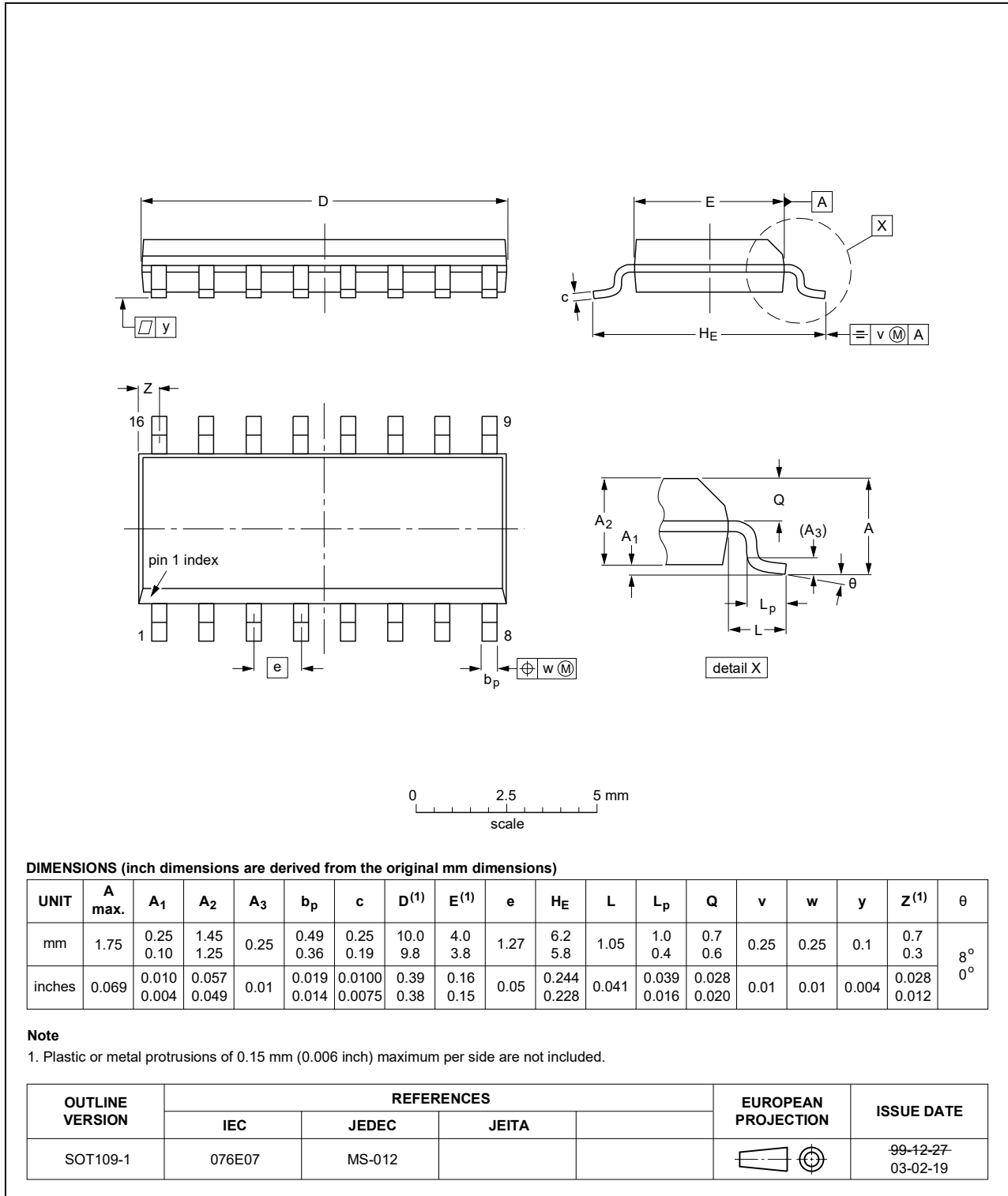


Fig. 16. Package outline SOT109-1 (SO16)

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

SOT338-1

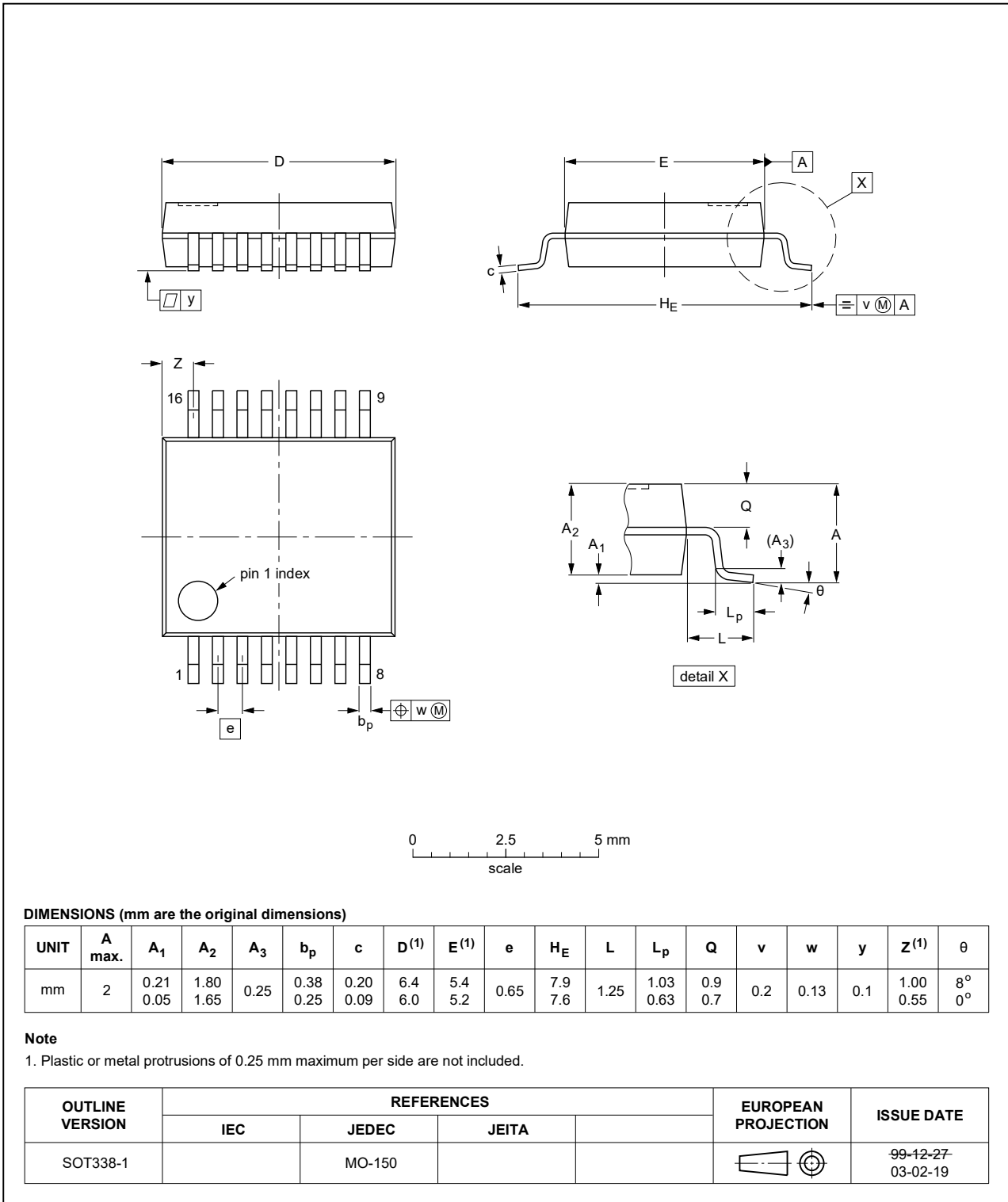


Fig. 17. Package outline SOT338-1 (SSOP16)



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

SOT403-1

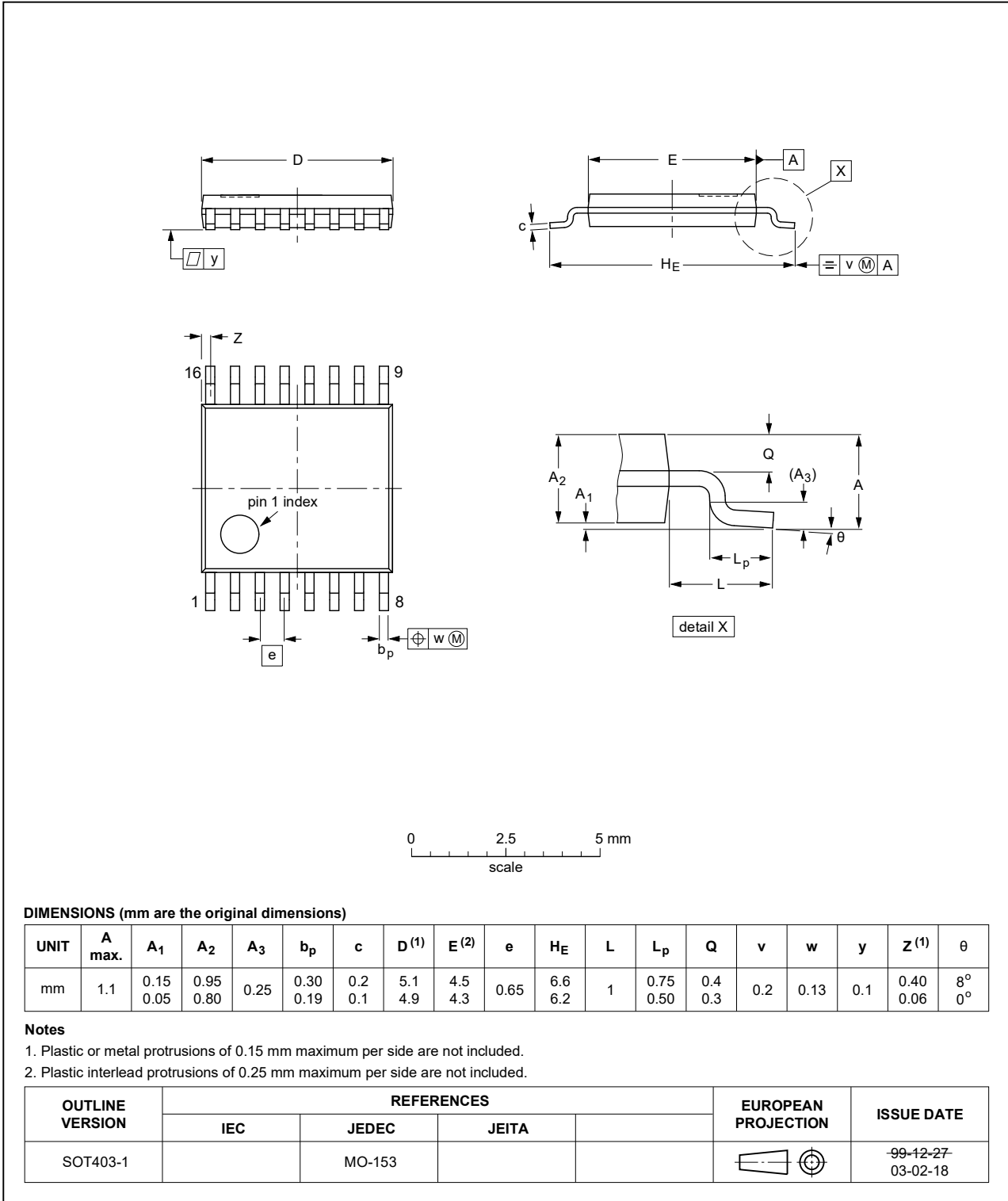


Fig. 18. Package outline SOT403-1 (TSSOP16)

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

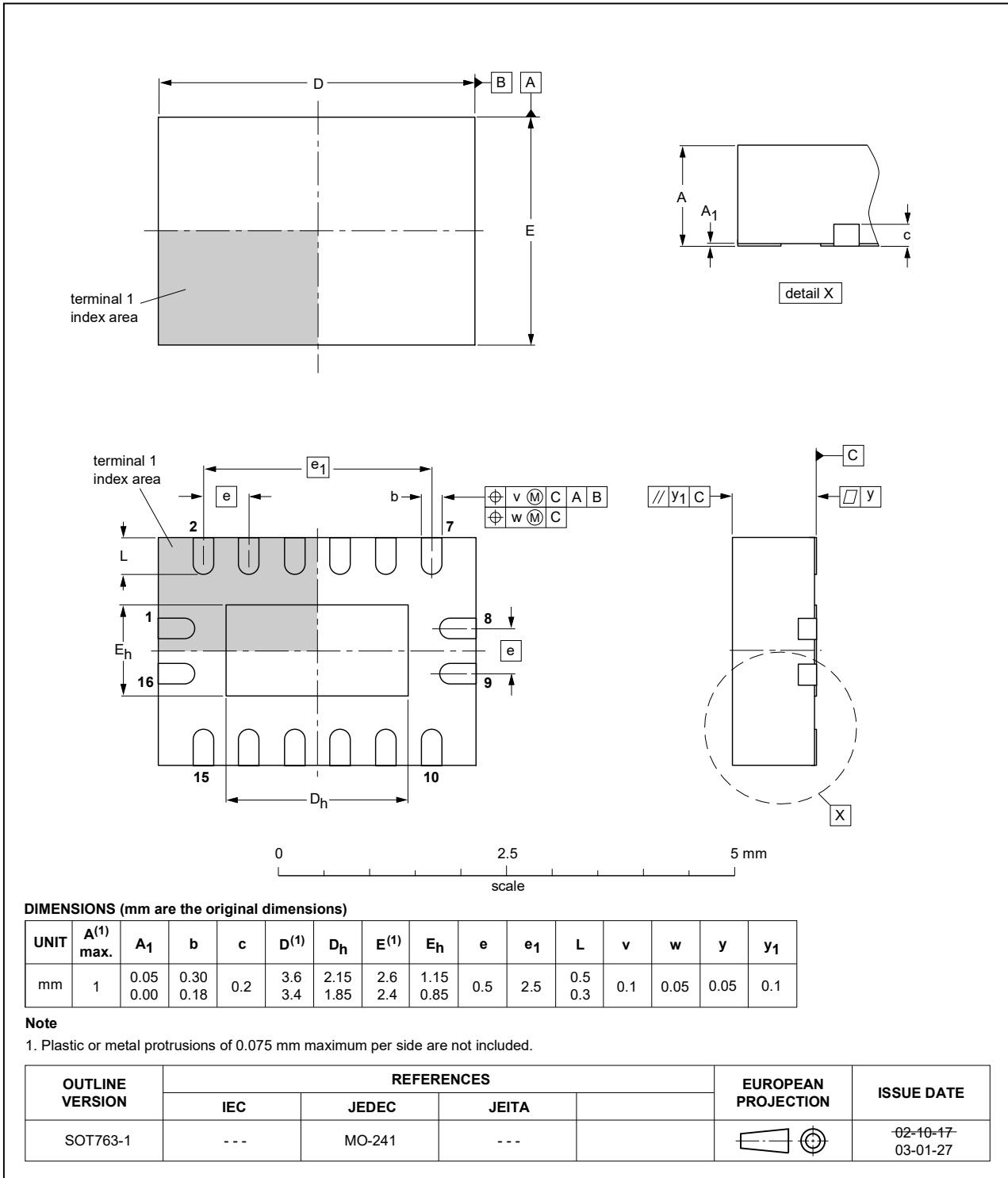


Fig. 19. Package outline SOT763-1 (DHVQFN16)

## 13. Abbreviations

Table 10. Abbreviations

| Acronym | Description                                    |
|---------|--|
| CDM     | Charged Device Model                           |
| CMOS    | Complementary Metal-Oxide Semiconductor        |
| DUT     | Device Under Test                              |
| ESD     | ElectroStatic Discharge                        |
| HBM     | Human Body Model                               |
| LSTTL   | Low-power Schottky Transistor-Transistor Logic |
| 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 v.3 | 20200625  | Product data sheet | -             | 74AHC_AHCT594 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 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 v.2 | 20080609  | Product data sheet | -             | 74AHC_AHCT594 v.1 |
| Modifications:    | <ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li><a href="#">Table 6</a>: the conditions for input leakage current have been changed.</li> </ul>   |                    |               |                   |
| 74AHC_AHCT594 v.1 | 20060704  | 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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