



THE DATASHEET OF 74HCT594D



74HC594; 74HCT594

8-bit shift register with output register

Rev. 4 — 25 February 2016

Product data sheet

1. General description

The 74HC594; 74HCT594 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 ($\overline{\text{SHR}}$ and $\overline{\text{STR}}$) 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} .

2. Features and benefits

- Synchronous serial input and output
- Complies with JEDEC standard No.7A
- 8-bit parallel output
- Shift and storage registers have independent direct clear and clocks
- Independent clocks for shift and storage registers
- 100 MHz (typical)
- Input levels:
 - ◆ For 74HC594: CMOS level
 - ◆ For 74HCT594: TTL level
- Multiple package options
- Specified from $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ and from $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$

3. Applications

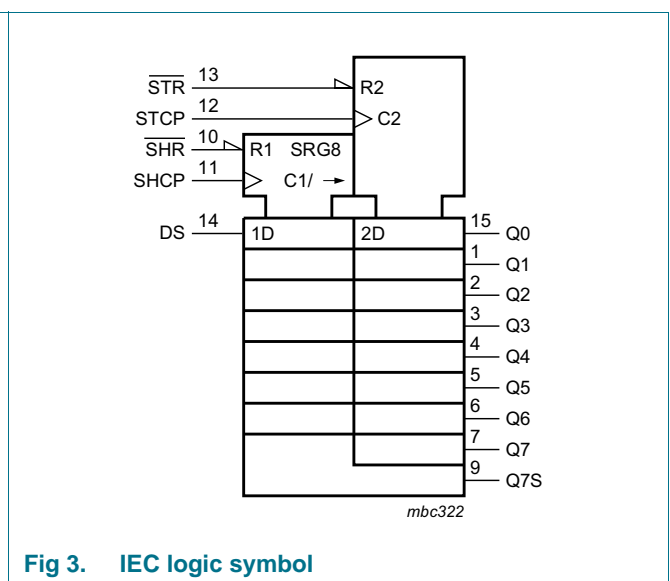
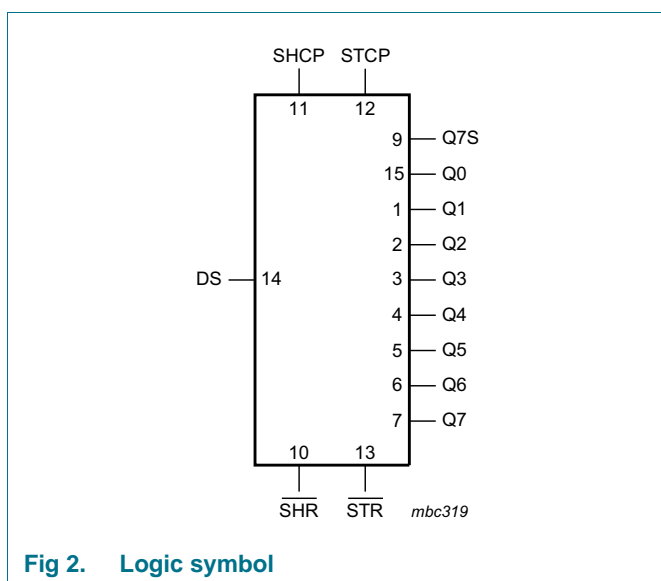
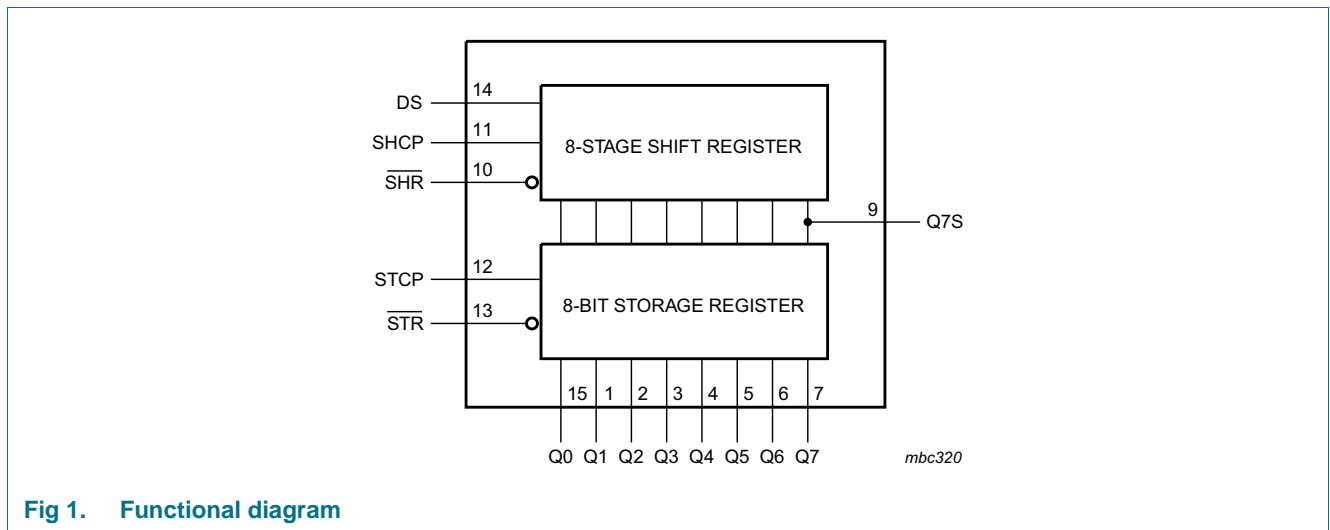
- Serial-to parallel data conversion
- Remote control holding register

4. Ordering information

Table 1. Ordering information

| Type number | Package | | | Version |
|-------------|-------------------|--------|--|----------|
| | Temperature range | Name | Description | |
| 74HC594D | -40 °C to +125 °C | SO16 | plastic small outline package; 16 leads; body width 3.9 mm | SOT109-1 |
| 74HCT594D | | | | |
| 74HC594DB | -40 °C to +125 °C | SSOP16 | plastic shrink small outline package; 16 leads; body width 5.3 mm | SOT338-1 |
| 74HCT594DB | | | | |

5. Functional diagram



6. Pinning information

6.1 Pinning

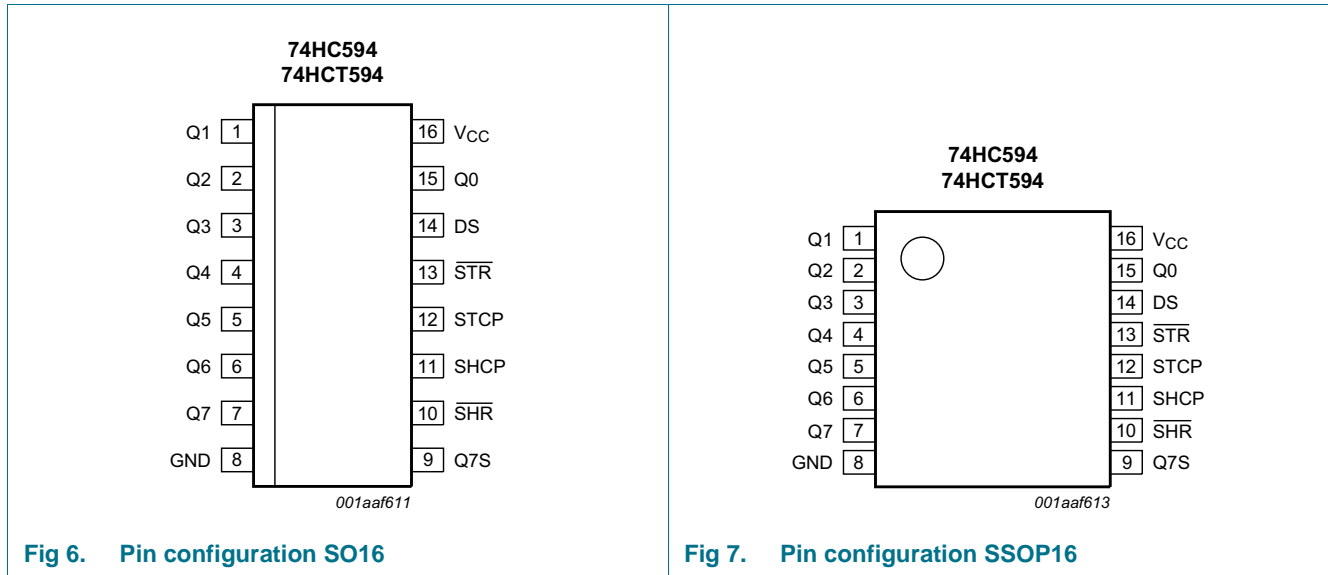


Fig 6. Pin configuration SO16

Fig 7. Pin configuration SSOP16

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 _{CC} | 16 | supply voltage |

7. Functional description

Table 3. Function table^[1]

| 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 |

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

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 V or V _I > V _{CC} + 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 | mA |
| I _O | output current | V _O = -0.5 V to V _{CC} + 0.5 V | | | |
| | | Serial data output Q7S | - | ±25 | mA |
| | | Parallel data output | - | ±35 | mA |
| I _{CC} | supply current | Serial data output Q7S | - | 50 | mA |
| | | Parallel data output | - | 70 | mA |
| I _{GND} | ground current | Serial data output Q7S | - | -50 | mA |
| | | Parallel data output | - | -70 | 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 SO16 packages: above 70 °C the value of P_{tot} derates linearly with 8 mW/K.
 For SSOP16 packages: above 60 °C the value of P_{tot} derates linearly with 5.5 mW/K.

9. Recommended operating conditions

Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V)

| Symbol | Parameter | Conditions | 74HC594 | | | 74HCT594 | | | 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 |
| Δt/ΔV | input transition rise and fall rate | V _{CC} = 2.0 V | - | - | 625 | - | - | - | ns/V |
| | | V _{CC} = 4.5 V | - | 1.67 | 139 | - | 1.67 | 139 | ns/V |
| | | V _{CC} = 6.0 V | - | - | 83 | - | - | - | ns/V |

10. Static characteristics

Table 6. Static characteristics type 74HC594

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

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|---------------------------|--|----------------|--|------|------|
| T_{amb} = 25 °C | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 2.0 V | 1.5 | 1.2 | - | V |
| | | V _{CC} = 4.5 V | 3.15 | 2.4 | - | V |
| | | V _{CC} = 6.0 V | 4.2 | 3.2 | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 2.0 V | - | 0.8 | 0.5 | V |
| | | V _{CC} = 4.5 V | - | 2.1 | 1.35 | V |
| | | V _{CC} = 6.0 V | - | 2.8 | 1.8 | V |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} | | | | |
| | | Serial data output Q7S | | | | |
| | | I _O = -4.0 mA; V _{CC} = 4.5 V | 3.98 | 4.32 | - | V |
| | | I _O = -5.2 mA; V _{CC} = 6.0 V | 5.48 | 5.81 | - | V |
| | | Parallel data outputs | | | | |
| | | I _O = -6.0 mA; V _{CC} = 4.5 V | 3.98 | 4.32 | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} | | | | |
| | | Serial data output Q7S | | | | |
| | | I _O = 4.0 mA; V _{CC} = 4.5 V | - | 0.15 | 0.26 | V |
| | | I _O = 5.2 mA; V _{CC} = 6.0 V | - | 0.16 | 0.26 | V |
| | | Parallel data outputs | | | | |
| | | I _O = 6.0 mA; V _{CC} = 4.5 V | - | 0.15 | 0.26 | V |
| I _I | input leakage current | V _I = V _{CC} or GND; V _{CC} = 6.0 V | - | - | ±0.1 | μA |
| | | I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 6.0 V | - | - |
| C _i | input capacitance | | - | 3.5 | - | pF |

Table 6. Static characteristics type 74HC594 ...continued

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

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--|---|--|------|-----|------|------|
| T_{amb} = -40 °C to +85 °C | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 2.0 V | 1.5 | - | - | V |
| | | V _{CC} = 4.5 V | 3.15 | - | - | V |
| | | V _{CC} = 6.0 V | 4.2 | - | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 2.0 V | - | - | 0.5 | V |
| | | V _{CC} = 4.5 V | - | - | 1.35 | V |
| | | V _{CC} = 6.0 V | - | - | 1.8 | V |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} | | | | |
| | | Serial data output Q7S | | | | |
| | | I _O = -4.0 mA; V _{CC} = 4.5 V | 3.84 | - | - | V |
| | | I _O = -5.2 mA; V _{CC} = 6.0 V | 5.34 | - | - | V |
| | | Parallel data outputs | | | | |
| | | I _O = -6.0 mA; V _{CC} = 4.5 V | 3.84 | - | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} | | | | |
| | | Serial data output Q7S | | | | |
| | | I _O = 4.0 mA; V _{CC} = 4.5 V | - | - | 0.33 | V |
| | | I _O = 5.2 mA; V _{CC} = 6.0 V | - | - | 0.33 | V |
| | | Parallel data outputs | | | | |
| | | I _O = 6.0 mA; V _{CC} = 4.5 V | - | - | 0.33 | V |
| I _I | input leakage current | V _I = V _{CC} or GND; V _{CC} = 6.0 V | - | - | ±1.0 | μA |
| | | | | | | |
| I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 6.0 V | - | - | 80 | μA |
| T_{amb} = -40 °C to +125 °C | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 2.0 V | 1.5 | - | - | V |
| | | V _{CC} = 4.5 V | 3.15 | - | - | V |
| | | V _{CC} = 6.0 V | 4.2 | - | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 2.0 V | - | - | 0.5 | V |
| | | V _{CC} = 4.5 V | - | - | 1.35 | V |
| | | V _{CC} = 6.0 V | - | - | 1.8 | V |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} | | | | |
| | | Serial data output Q7S | | | | |
| | | I _O = -4.0 mA; V _{CC} = 4.5 V | 3.7 | - | - | V |
| | | I _O = -5.2 mA; V _{CC} = 6.0 V | 5.2 | - | - | V |
| | | Parallel data outputs | | | | |
| | | I _O = -6.0 mA; V _{CC} = 4.5 V | 3.7 | - | - | V |
| | I _O = -7.8 mA; V _{CC} = 6.0 V | 5.2 | - | - | V | |

Table 6. Static characteristics type 74HC594 ...continued

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

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------|--------------------------|---|-----|-----|------|------|
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} | | | | |
| | | Serial data output Q7S | | | | |
| | | I _O = 4.0 mA; V _{CC} = 4.5 V | - | - | 0.4 | V |
| | | I _O = 5.2 mA; V _{CC} = 6.0 V | - | - | 0.4 | V |
| | | Parallel data outputs | | | | |
| | | I _O = 6.0 mA; V _{CC} = 4.5 V | - | - | 0.4 | V |
| I _I | input leakage current | V _I = V _{CC} or GND; V _{CC} = 6.0 V | - | - | ±1.0 | μA |
| | | I _O = 7.8 mA; V _{CC} = 6.0 V | - | - | 0.4 | V |
| I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 6.0 V | - | - | 160 | μA |

Table 7. Static characteristics type 74HCT594

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

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|---------------------------|--|------|------|------|------|
| T_{amb} = 25 °C | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 4.5 V to 5.5 V | 2.0 | 1.6 | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 4.5 V to 5.5 V | - | 1.2 | 0.8 | V |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} | | | | |
| | | Serial data output Q7S | | | | |
| | | I _O = -4.0 mA; V _{CC} = 4.5 V | 3.98 | 4.32 | - | V |
| | | Parallel data outputs | | | | |
| V _{OL} | LOW-level output voltage | I _O = -6.0 mA; V _{CC} = 4.5 V | 3.98 | 4.32 | - | V |
| | | V _I = V _{IH} or V _{IL} | | | | |
| | | Serial data output Q7S | | | | |
| | | I _O = 4.0 mA; V _{CC} = 4.5 V | - | 0.15 | 0.26 | V |
| I _I | input leakage current | V _I = V _{CC} or GND; V _{CC} = 5.5 V | - | - | ±0.1 | μA |
| | | I _O = 6.0 mA; V _{CC} = 4.5 V | - | 0.16 | 0.26 | V |
| I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V | - | - | 8.0 | μA |
| ΔI _{CC} | additional supply current | per input pin; V _I = V _{CC} - 2.1 V and other inputs at V _{CC} or GND; I _O = 0 A; V _{CC} = 4.5 V to 5.5 V | | | | |
| | | pins $\overline{\text{SHR}}$, SHCP, STCP, $\overline{\text{STR}}$ | - | 150 | 540 | μA |
| | | pin DS | - | 25 | 90 | μA |
| C _i | input capacitance | | - | 3.5 | - | pF |

Table 7. Static characteristics type 74HCT594 ...continued

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

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

11. Dynamic characteristics

Table 8. Dynamic characteristics type 74HC594

$GND = 0\text{ V}$; $t_r = t_f = 6\text{ ns}$; $C_L = 50\text{ pF}$; see [Figure 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 Figure 8 ^[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 Figure 9 | | | | | | | | |
| | | $V_{CC} = 2.0\text{ V}$ | - | 44 | 150 | - | 185 | - | 225 | ns |
| | | $V_{CC} = 4.5\text{ V}$ | - | 16 | 30 | - | 37 | - | 45 | ns |
| t_{PHL} | HIGH to LOW propagation delay | SHR to Q7S; see Figure 12 | | | | | | | | |
| | | $V_{CC} = 2.0\text{ V}$ | - | 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 Figure 13 | | | | | | | | |
| | | $V_{CC} = 2.0\text{ V}$ | - | 39 | 125 | - | 155 | - | 185 | ns |
| | | $V_{CC} = 4.5\text{ V}$ | - | 14 | 25 | - | 31 | - | 37 | ns |
| t_{THL} | HIGH to LOW output transition time | Q7S; see Figure 8 | | | | | | | | |
| | | $V_{CC} = 2.0\text{ V}$ | - | 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 |
| t_{TLH} | LOW to HIGH output transition time | Q7S; see Figure 8 | | | | | | | | |
| | | $V_{CC} = 2.0\text{ V}$ | - | 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 | | |

Table 8. Dynamic characteristics type 74HC594 ...continued

GND = 0 V; $t_r = t_f = 6$ ns; $C_L = 50$ pF; see [Figure 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_w | pulse width | SHCP (HIGH or LOW); see Figure 8 | | | | | | | | |
| | | $V_{CC} = 2.0$ V | 80 | 10 | - | 100 | - | 120 | - | ns |
| | | $V_{CC} = 4.5$ V | 16 | 4 | - | 20 | - | 24 | - | ns |
| | | $V_{CC} = 6.0$ V | 14 | 3 | - | 17 | - | 20 | - | ns |
| | | STCP (HIGH or LOW); see Figure 9 | | | | | | | | |
| | | $V_{CC} = 2.0$ V | 80 | 10 | - | 100 | - | 120 | - | ns |
| | | $V_{CC} = 4.5$ V | 16 | 4 | - | 20 | - | 24 | - | ns |
| | | $V_{CC} = 6.0$ V | 14 | 3 | - | 17 | - | 20 | - | ns |
| | | SHR and STR (HIGH or LOW); see Figure 12 and Figure 13 | | | | | | | | |
| | | $V_{CC} = 2.0$ V | 80 | 14 | - | 100 | - | 120 | - | ns |
| | | $V_{CC} = 4.5$ V | 16 | 5 | - | 20 | - | 24 | - | ns |
| | | $V_{CC} = 6.0$ V | 14 | 4 | - | 17 | - | 20 | - | ns |
| t_{su} | set-up time | DS to SHCP; see Figure 10 | | | | | | | | |
| | | $V_{CC} = 2.0$ V | 100 | 10 | - | 125 | - | 150 | - | ns |
| | | $V_{CC} = 4.5$ V | 20 | 4 | - | 25 | - | 30 | - | ns |
| | | $V_{CC} = 6.0$ V | 17 | 3 | - | 21 | - | 26 | - | ns |
| | | SHR to STCP; see Figure 11 | | | | | | | | |
| | | $V_{CC} = 2.0$ V | 100 | 14 | - | 125 | - | 150 | - | ns |
| | | $V_{CC} = 4.5$ V | 20 | 5 | - | 25 | - | 30 | - | ns |
| | | $V_{CC} = 6.0$ V | 17 | 4 | - | 21 | - | 26 | - | ns |
| | | SHCP to STCP; see Figure 9 | | | | | | | | |
| | | $V_{CC} = 2.0$ V | 100 | 17 | - | 125 | - | 150 | - | ns |
| | | $V_{CC} = 4.5$ V | 20 | 6 | - | 25 | - | 30 | - | ns |
| | | $V_{CC} = 6.0$ V | 17 | 5 | - | 21 | - | 26 | - | ns |
| t_h | hold time | DS to SHCP; see Figure 10 | | | | | | | | |
| | | $V_{CC} = 2.0$ V | 25 | −8 | - | 30 | - | 35 | - | ns |
| | | $V_{CC} = 4.5$ V | 5 | −3 | - | 6 | - | 7 | - | ns |
| | | $V_{CC} = 6.0$ V | 4 | −2 | - | 5 | - | 6 | - | ns |
| t_{rec} | recovery time | SHR to SHCP and STR to STCP; see Figure 12 and Figure 13 | | | | | | | | |
| | | $V_{CC} = 2.0$ V | 50 | −14 | - | 65 | - | 75 | - | ns |
| | | $V_{CC} = 4.5$ V | 10 | −5 | - | 13 | - | 15 | - | ns |
| | | $V_{CC} = 6.0$ V | 9 | −4 | - | 11 | - | 13 | - | ns |

Table 8. Dynamic characteristics type 74HC594 ...continuedGND = 0 V; $t_r = t_f = 6$ ns; $C_L = 50$ pF; see [Figure 14](#).

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|------------------|-------------------------------|---|-------|-----|-----|------------------|-----|-------------------|-----|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| f _{max} | maximum frequency | SHCP or STCP; see Figure 8 and Figure 9 | | | | | | | | |
| | | V _{CC} = 2.0 V | 6.0 | 30 | - | 4.8 | - | 4.0 | - | MHz |
| | | V _{CC} = 4.5 V | 30 | 92 | - | 24 | - | 20 | - | MHz |
| | | V _{CC} = 5.0 V; C _L = 15 pF | - | 100 | - | - | - | - | - | MHz |
| | | V _{CC} = 6.0 V | 35 | 109 | - | 28 | - | 24 | - | MHz |
| C _{PD} | power dissipation capacitance | V _I = GND to V _{CC} ; V _{CC} = 5 V; f _i = 1 MHz [2] | - | 84 | - | - | - | - | - | pF |

[1] t_{pd} is the same as t_{PHL} and t_{PLH}.[2] C_{PD} is used to determine the dynamic power dissipation (P_D in μW):

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

f_i = input frequency in MHz;f_o = output frequency in MHz;C_L = output load capacitance in pF;V_{CC} = supply voltage in V;

N = number of inputs switching;

 $\sum(C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.**Table 9.** Dynamic characteristics type 74HCT594GND = 0 V; V_{CC} = 4.5 V; $t_r = t_f = 6$ ns; C_L = 50 pF; see [Figure 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 Figure 8 [1] | - | 18 | 32 | - | 40 | - | 48 | ns |
| | | V _{CC} = 5.0 V; C _L = 15 pF | - | 15 | - | - | - | - | - | ns |
| | | STCP to Qn; see Figure 9 | - | 18 | 32 | - | 40 | - | 48 | ns |
| | | V _{CC} = 5.0 V; C _L = 15 pF | - | 15 | - | - | - | - | - | ns |
| t _{PHL} | HIGH to LOW propagation delay | SHR to Q7S; see Figure 12 | - | 17 | 30 | - | 38 | - | 45 | ns |
| | | V _{CC} = 5.0 V; C _L = 15 pF | - | 14 | - | - | - | - | - | ns |
| | | STR to Qn; see Figure 13 | - | 17 | 30 | - | 38 | - | 45 | ns |
| | | V _{CC} = 5.0 V; C _L = 15 pF | - | 14 | - | - | - | - | - | ns |
| t _{THL} | HIGH to LOW output transition time | Q7S; see Figure 8 | | | | | | | | |
| | | V _{CC} = 4.5 V | - | 7 | 15 | - | 19 | - | 22 | ns |
| | | Qn | | | | | | | | |
| | | V _{CC} = 4.5 V | - | 5 | 12 | - | 15 | - | 18 | ns |
| t _{TLH} | LOW to HIGH output transition time | Q7S; see Figure 8 | | | | | | | | |
| | | V _{CC} = 4.5 V | - | 7 | 15 | - | 19 | - | 22 | ns |
| | | Qn | | | | | | | | |
| | | V _{CC} = 4.5 V | - | 5 | 12 | - | 15 | - | 18 | ns |

Table 9. Dynamic characteristics type 74HCT594 ...continued
GND = 0 V; V_{CC} = 4.5 V; t_r = t_f = 6 ns; C_L = 50 pF; see Figure 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 _W | pulse width | SHCP (HIGH or LOW); see Figure 8 | 16 | 4 | - | 20 | - | 24 | - | ns |
| | | STCP (HIGH or LOW); see Figure 9 | 16 | 4 | - | 20 | - | 24 | - | ns |
| | | SHR and STR (HIGH or LOW); see Figure 12 and Figure 13 | 16 | 6 | - | 20 | - | 24 | - | ns |
| t _{su} | set-up time | DS to SHCP; see Figure 10 | 20 | 4 | - | 25 | - | 30 | - | ns |
| | | SHR to STCP; see Figure 11 | 20 | 6 | - | 25 | - | 30 | - | ns |
| | | SHCP to STCP; see Figure 9 | 20 | 7 | - | 25 | - | 30 | - | ns |
| t _h | hold time | DS to SHCP; see Figure 10 | 5 | −3 | - | 6 | - | 7 | - | ns |
| t _{rec} | recovery time | SHR to SHCP and STR to STCP; see Figure 12 and Figure 13 | 10 | −5 | - | 13 | - | 15 | - | ns |
| f _{max} | maximum frequency | SHCP or STCP; see Figure 8 and Figure 9 | 30 | 92 | - | 24 | - | 20 | - | MHz |
| | | V _{CC} = 5.0 V; C _L = 15 pF | - | 100 | - | - | - | - | - | MHz |
| C _{PD} | power dissipation capacitance | V _I = GND to V _{CC} − 1.5 V; V _{CC} = 5 V; f _i = 1 MHz [2] | - | 89 | - | - | - | - | - | pF |

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

[2] C_{PD} is used to determine the dynamic power dissipation (P_D in μW):

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

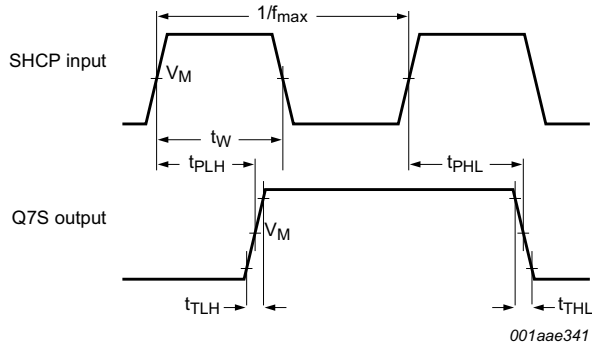
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

∑(C_L × V_{CC}² × f_o) = sum of outputs.

12. Waveforms

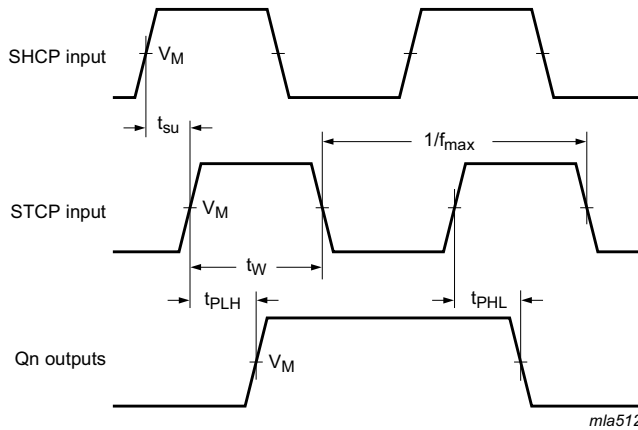


Measurement points are given in [Table 10](#).

t_{PLH} and t_{PHL} are the same as t_{pd} .

t_{TLH} = LOW to HIGH output transition time; t_{THL} = HIGH to LOW output transition time.

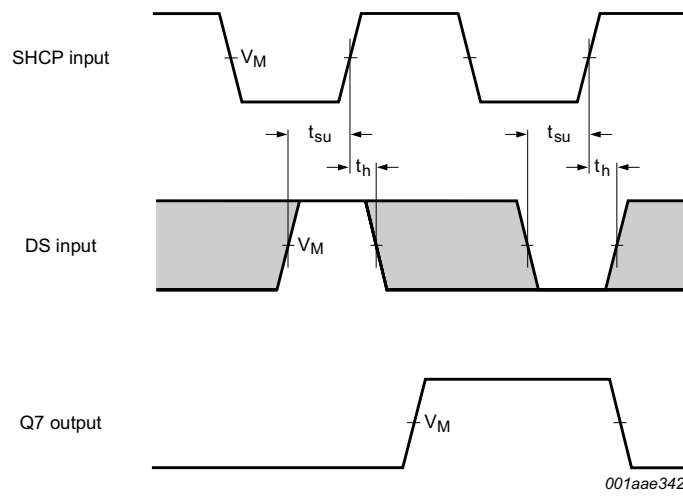
Fig 8. The shift clock (SHCP) to output (Q7S) propagation delays, the shift clock pulse width, the maximum shift clock frequency, and output transition times



Measurement points are given in [Table 10](#).

t_{PLH} and t_{PHL} are the same as t_{pd} .

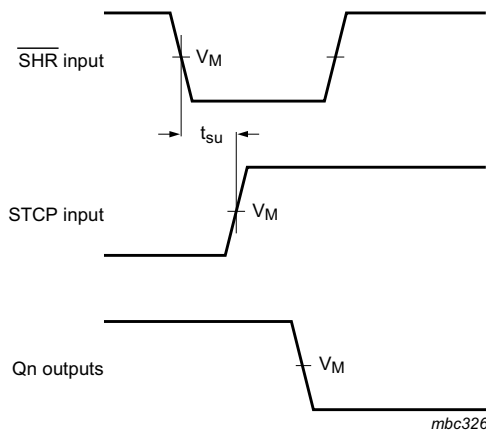
Fig 9. The storage clock (STCP) to output (Qn), propagation delays, the storage clock pulse width, the maximum storage clock pulse frequency and the shift clock to storage clock set-up time



Measurement points are given in [Table 10](#).

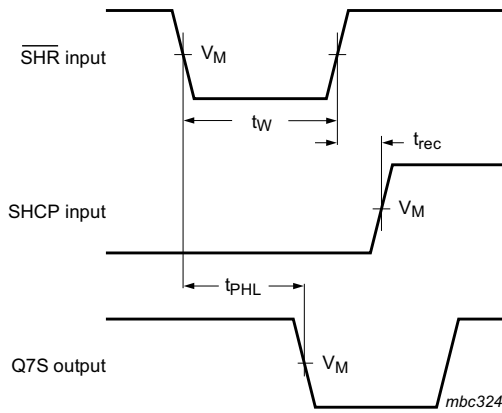
The shaded areas indicate when the input is permitted to change for predictable output performance.

Fig 10. The data set-up time and hold times for DS input to SHCP



Measurement points are given in [Table 10](#).

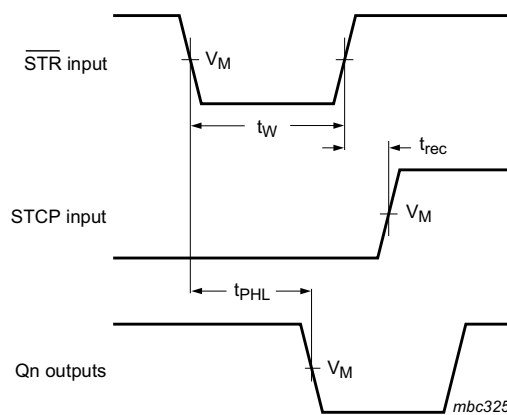
Fig 11. The set-up time shift reset (SHR) to storage clock (STCP)



Measurement points are given in [Table 10](#).

t_{PLH} and t_{PHL} are the same as t_{pd} .

Fig 12. The shift reset ($\overline{\text{SHR}}$) pulse width, the shift reset to output (Q7S) propagation delay and the shift reset to shift clock (SHCP) recovery time



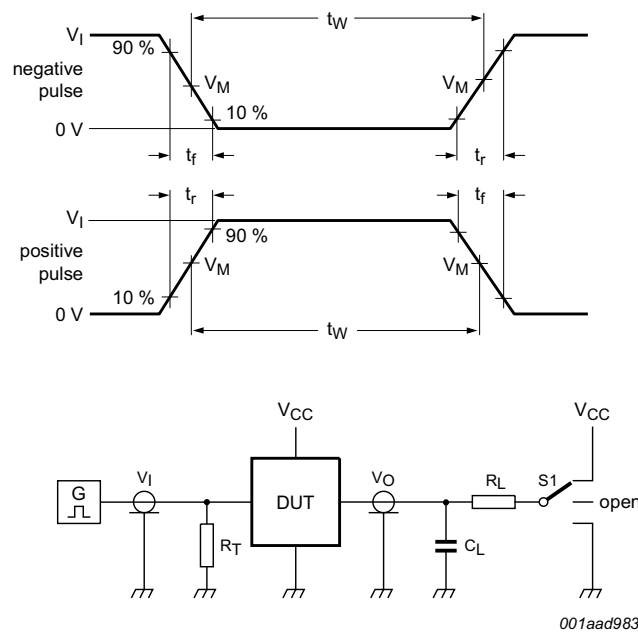
Measurement points are given in [Table 10](#).

t_{PLH} and t_{PHL} are the same as t_{pd} .

Fig 13. The storage reset ($\overline{\text{STR}}$) pulse width, the storage reset to output (Qn) propagation delay and the storage reset to storage clock (STCP) recovery time

Table 10. Measurement points

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



Test data is given in [Table 11](#).

Definitions 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

R_L = Load resistance

S1 = Test selection switch

Fig 14. Test circuit for measuring switching times

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 | V_{CC} | 6 ns | 15 pF, 50 pF | 1 k Ω | open | GND | V_{CC} |
| 74HCT594 | 3 V | 6 ns | 15 pF, 50 pF | 1 k Ω | open | GND | V_{CC} |

13. Package outline

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

SOT109-1

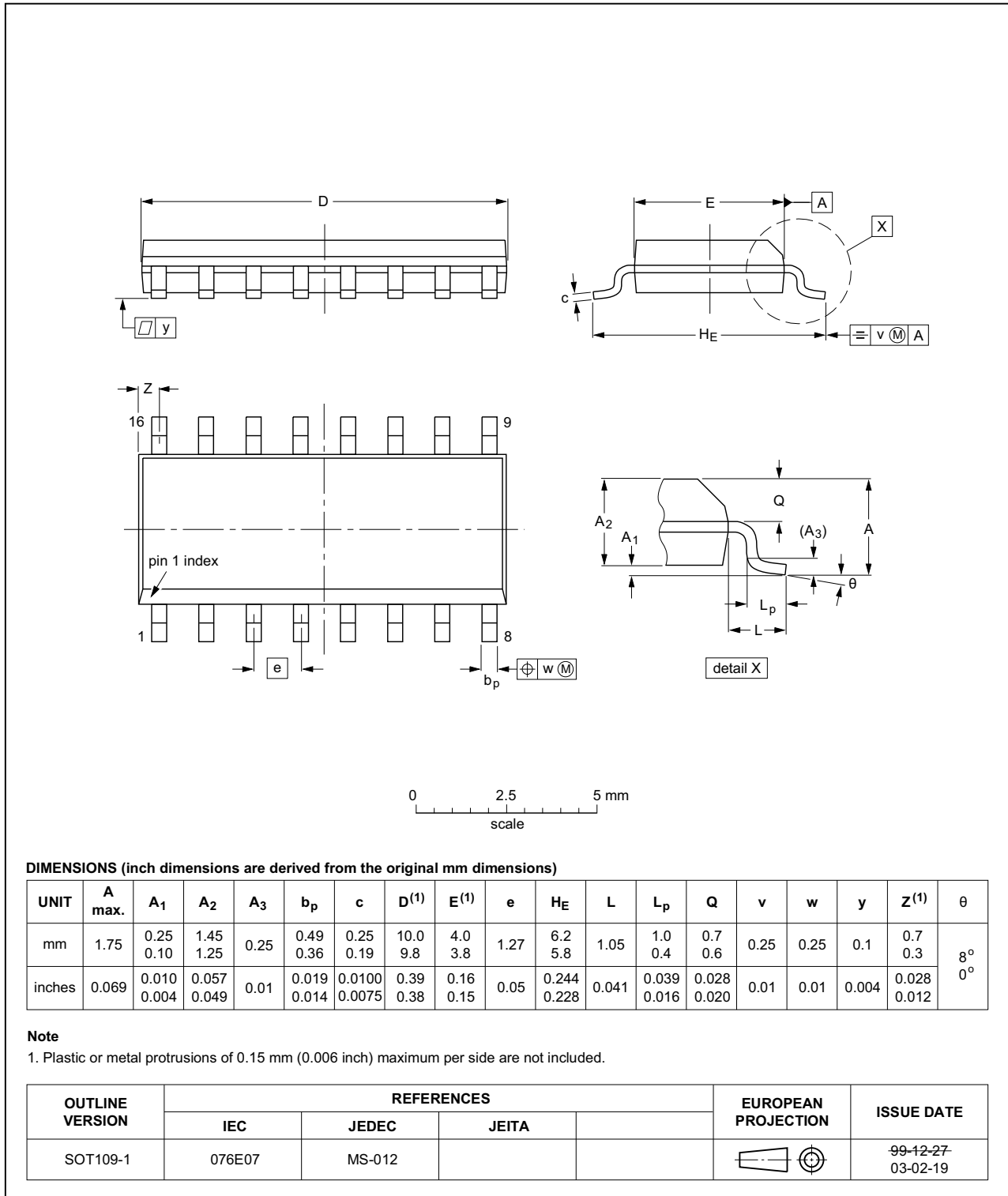


Fig 15. Package outline SOT109-1 (SO16)

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

SOT338-1

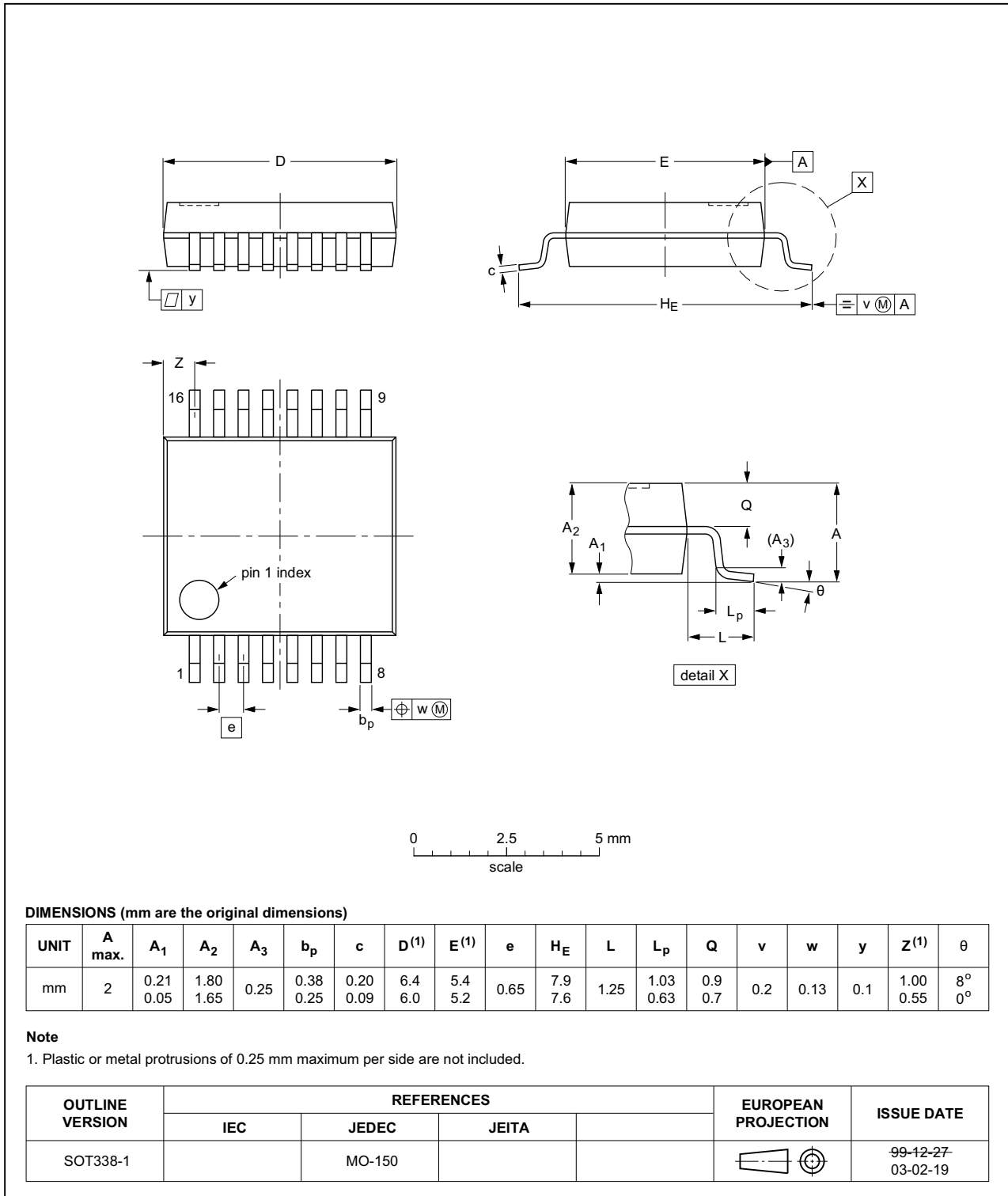


Fig 16. Package outline SOT338-1 (SSOP16)

14. Abbreviations

Table 12. Abbreviations

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

15. Revision history

Table 13. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---------------------|--|-----------------------|---------------|---------------------|
| 74HC_HCT594 v.4 | 20160225 | Product data sheet | - | 74HC_HCT594 v.3 |
| Modifications: | <ul style="list-style-type: none"> Type numbers 74HC594N and 74HCT594N (SOT38-4) removed. | | | |
| 74HC_HCT594 v.3 | 20061220 | Product data sheet | - | 74HC_HCT594_CNV v.2 |
| Modifications: | <ul style="list-style-type: none"> The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. Legal texts have been adapted to the new company name where appropriate. Table 1 "Ordering information" updated. | | | |
| 74HC_HCT594_CNV v.2 | 19970908 | Product specification | - | 74HC_HCT594_CNV v.1 |

16. Legal information

16.1 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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