

# 74LVC594A

## 8-bit shift register with output register

Rev. 2 — 21 October 2013

Product data sheet

### 1. General description

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The 74LVC594A 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 input can be driven from either 3.3 V or 5 V devices. This feature allows the use of this device in a mixed 3.3 V and 5 V environment.

This device is fully specified for partial Power-down applications using  $I_{OFF}$ . The  $I_{OFF}$  circuitry disables the output, preventing the damaging backflow current through the device when it is powered down.

The shift register has a serial input (DS) and a serial output (Q7S) for cascading purposes. Data is shifted on the positive-going transitions of the SHCP input. The data in the shift register is transferred to the storage register on a positive-going 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 ( $\overline{SHR}$  and  $\overline{STR}$ ) will clear the corresponding register.

### 2. Features and benefits

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- 5 V tolerant inputs/outputs for interfacing with 5 V logic
- Wide supply voltage range from 1.2 V to 3.6 V
- CMOS low-power consumption
- Direct interface with TTL levels
- Balanced propagation delays
- All inputs have Schmitt-trigger action
- Complies with JEDEC standard:
  - ◆ JESD8-7A (1.65 V to 1.95 V)
  - ◆ JESD8-5A (2.3 V to 2.7 V)
  - ◆ JESD8-C/JESD36 (2.7 V to 3.6 V)
- ESD protection:
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ CDM JESD22-C101E exceeds 1000 V
- Specified from  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  and  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$

### 3. Applications

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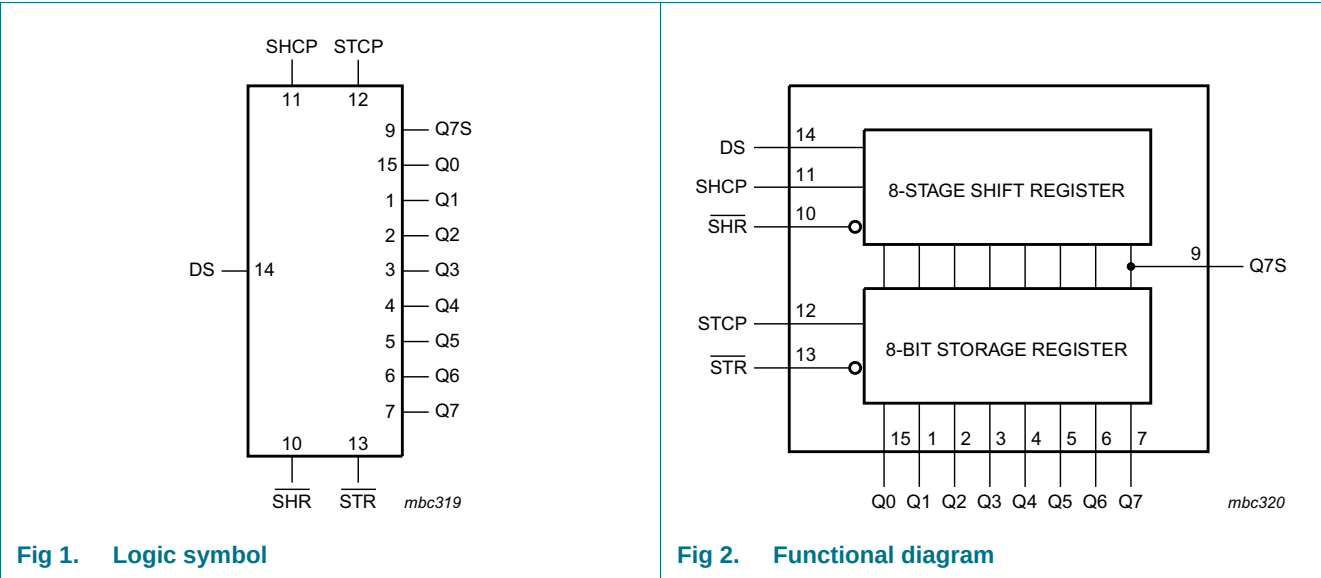
- Serial-to-parallel data conversion
- Remote control holding register



4. Ordering information

| Table 1. Ordering information |                   |          |                                                                                                                                      |          |
|-------------------------------|-------------------|----------|--------------------------------------------------------------------------------------------------------------------------------------|----------|
| Type number                   | Package           |          |                                                                                                                                      |          |
|                               | Temperature range | Name     | Description                                                                                                                          | Version  |
| 74LVC594AD                    | −40 °C to +125 °C | SO16     | plastic small outline package; 16 leads;<br>body width 3.9 mm                                                                        | SOT109-1 |
| 74LVC594APW                   | −40 °C to +125 °C | TSSOP16  | plastic thin shrink small outline package; 16 leads;<br>body width 4.4 mm                                                            | SOT403-1 |
| 74LVC594ABQ                   | −40 °C to +125 °C | DHVQFN16 | plastic dual in-line compatible thermal enhanced<br>very thin quad flat package; no leads; 16<br>terminals; body 2.5 × 3.5 × 0.85 mm | SOT763-1 |

5. Functional diagram



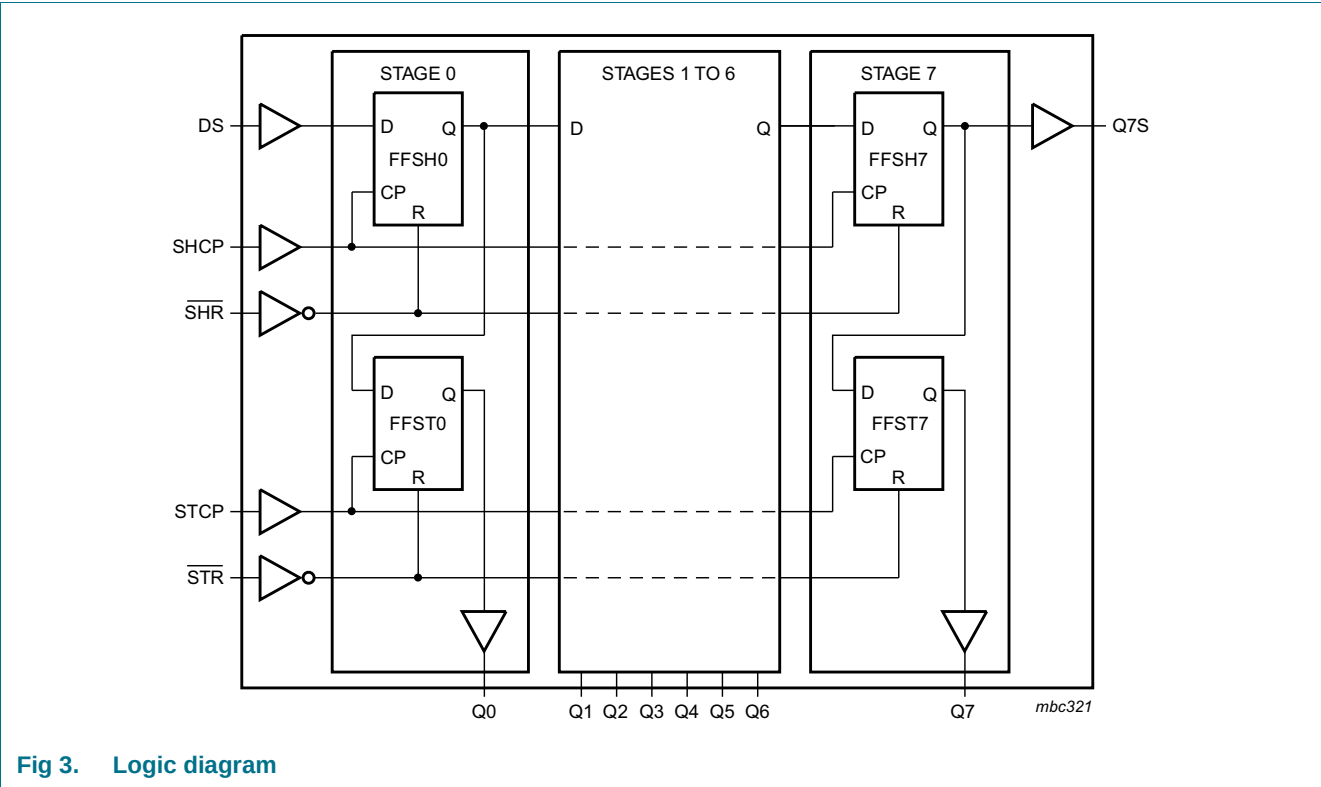


Fig 3. Logic diagram

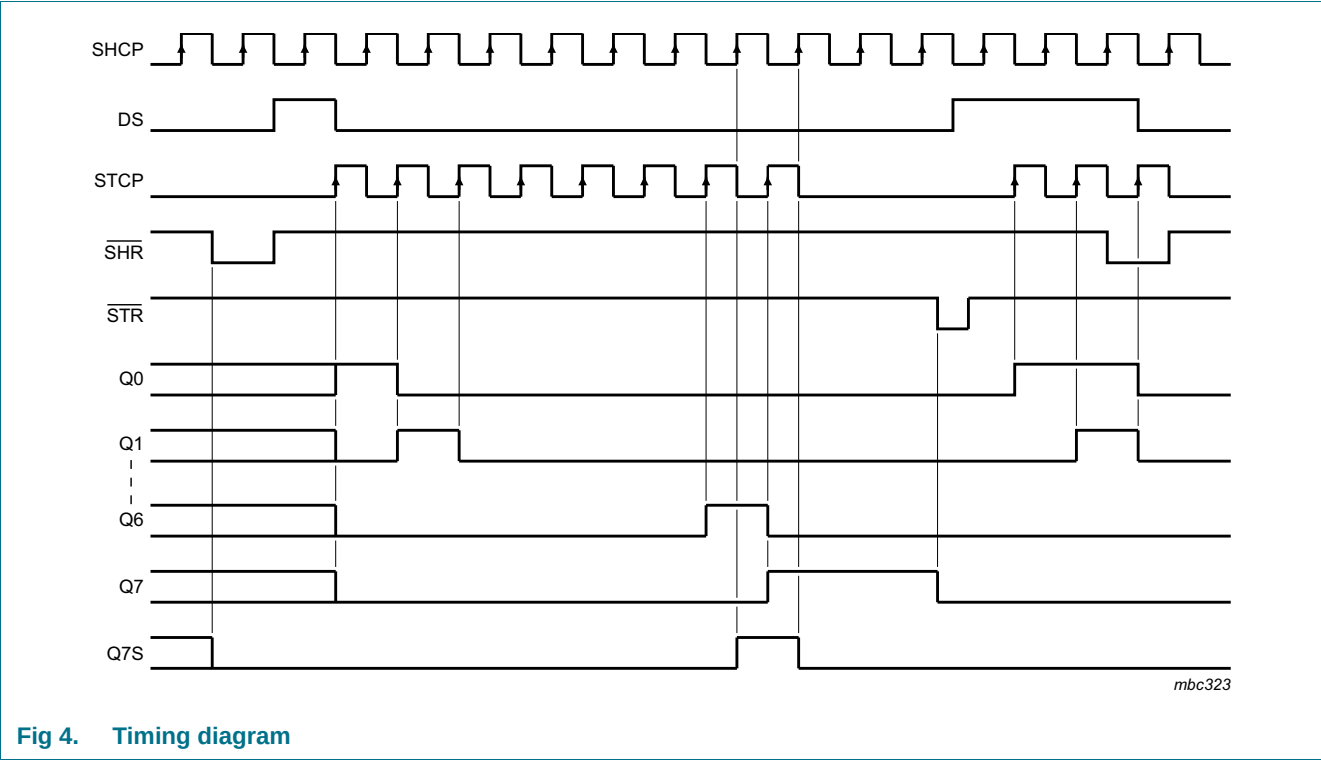
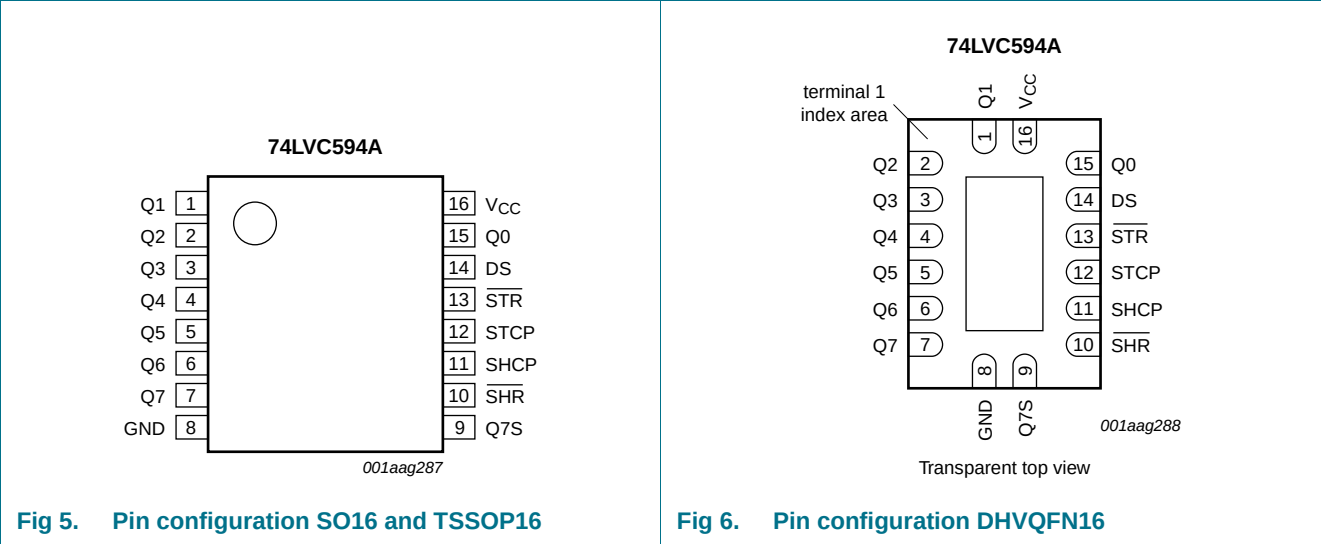


Fig 4. Timing diagram

6. Pinning information

6.1 Pinning



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<sup>[1]</sup>

| 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                                      |

- [1] H = HIGH voltage state;  
 L = LOW voltage state;  
 ↑ = LOW-to-HIGH transition;  
 X = don't care;  
 NC = no change;

## 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                | +6.5           | V    |
| $I_{IK}$  | input clamping current  | $V_I < 0$ V                   | -50                 | -              | mA   |
| $V_I$     | input voltage           |                               | <sup>[1]</sup> -0.5 | +6.5           | V    |
| $I_{OK}$  | output clamping current | $V_O > V_{CC}$ or $V_O < 0$ V | -                   | ±50            | mA   |
| $V_O$     | output voltage          | 3-state                       | <sup>[1]</sup> -0.5 | 6.5            | V    |
|           |                         | output HIGH or LOW state      | <sup>[1]</sup> -0.5 | $V_{CC} + 0.5$ | V    |
| $I_O$     | output current          | $V_O = 0$ V to $V_{CC}$       | -                   | ±50            | mA   |
| $I_{CC}$  | supply current          |                               | -                   | 100            | mA   |
| $I_{GND}$ | ground current          |                               | -100                | -              | mA   |
| $T_{stg}$ | storage temperature     |                               | -65                 | +150           | °C   |
| $P_{tot}$ | total power dissipation | $T_{amb} = -40$ °C to +125 °C | <sup>[2]</sup> -    | 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 TSSOP16 packages: above 60 °C the value of  $P_{tot}$  derates linearly with 5.5 mW/K.  
 For DHVQFN16 packages: above 60 °C the value of  $P_{tot}$  derates linearly with 4.5 mW/K.

## 9. Recommended operating conditions

**Table 5. Recommended operating conditions**

| Symbol           | Parameter                           | Conditions                        | Min  | Typ | Max             | Unit |
|------------------|-------------------------------------|-----------------------------------|------|-----|-----------------|------|
| V <sub>CC</sub>  | supply voltage                      |                                   | 1.65 | -   | 3.6             | V    |
|                  |                                     | functional                        | 1.2  | -   | -               | V    |
| V <sub>I</sub>   | input voltage                       |                                   | 0    | -   | 5.5             | V    |
| V <sub>O</sub>   | output voltage                      | 3-state                           | 0    | -   | 5.5             | V    |
|                  |                                     | output HIGH or LOW state          | 0    | -   | V <sub>CC</sub> | V    |
| T <sub>amb</sub> | ambient temperature                 |                                   | -40  | -   | +125            | °C   |
| Δt/ΔV            | input transition rise and fall rate | V <sub>CC</sub> = 1.65 V to 2.7 V | -    | -   | 20              | ns/V |
|                  |                                     | V <sub>CC</sub> = 2.7 V to 3.6 V  | -    | -   | 10              | ns/V |

## 10. Static characteristics

**Table 6. Static characteristics**

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

| Symbol          | Parameter                 | Conditions                                                  | -40 °C to +85 °C       |                    |                        | -40 °C to +125 °C      |                        | Unit |
|-----------------|---------------------------|-------------------------------------------------------------|------------------------|--------------------|------------------------|------------------------|------------------------|------|
|                 |                           |                                                             | Min                    | Typ <sup>[1]</sup> | Max                    | Min                    | Max                    |      |
| V <sub>IH</sub> | HIGH-level input voltage  | V <sub>CC</sub> = 1.2 V                                     | 1.08                   | -                  | -                      | 1.08                   | -                      | V    |
|                 |                           | V <sub>CC</sub> = 1.65 V to 1.95 V                          | 0.65 × V <sub>CC</sub> | -                  | -                      | 0.65 × V <sub>CC</sub> | -                      | V    |
|                 |                           | V <sub>CC</sub> = 2.3 V to 2.7 V                            | 1.7                    | -                  | -                      | 1.7                    | -                      | V    |
|                 |                           | V <sub>CC</sub> = 2.7 V to 3.6 V                            | 2.0                    | -                  | -                      | 2.0                    | -                      | V    |
| V <sub>IL</sub> | LOW-level input voltage   | V <sub>CC</sub> = 1.2 V                                     | -                      | -                  | 0.12                   | -                      | 0.12                   | V    |
|                 |                           | V <sub>CC</sub> = 1.65 V to 1.95 V                          | -                      | -                  | 0.35 × V <sub>CC</sub> | -                      | 0.35 × V <sub>CC</sub> | V    |
|                 |                           | V <sub>CC</sub> = 2.3 V to 2.7 V                            | -                      | -                  | 0.7                    | -                      | 0.7                    | V    |
|                 |                           | V <sub>CC</sub> = 2.7 V to 3.6 V                            | -                      | -                  | 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> = -100 μA; V <sub>CC</sub> = 1.65 V to 3.6 V | V <sub>CC</sub> - 0.2  | -                  | -                      | V <sub>CC</sub> - 0.3  | -                      | V    |
|                 |                           | I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 1.65 V            | 1.2                    | -                  | -                      | 1.05                   | -                      | V    |
|                 |                           | I <sub>O</sub> = -8 mA; V <sub>CC</sub> = 2.3 V             | 1.8                    | -                  | -                      | 1.65                   | -                      | V    |
|                 |                           | I <sub>O</sub> = -12 mA; V <sub>CC</sub> = 2.7 V            | 2.2                    | -                  | -                      | 2.05                   | -                      | V    |
|                 |                           | I <sub>O</sub> = -18 mA; V <sub>CC</sub> = 3.0 V            | 2.4                    | -                  | -                      | 2.25                   | -                      | V    |
|                 |                           | I <sub>O</sub> = -24 mA; V <sub>CC</sub> = 3.0 V            | 2.2                    | -                  | -                      | 2.0                    | -                      | 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> = 100 μA; V <sub>CC</sub> = 1.65 V to 3.6 V  | -                      | -                  | 0.2                    | -                      | 0.3                    | V    |
|                 |                           | I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V             | -                      | -                  | 0.45                   | -                      | 0.65                   | V    |
|                 |                           | I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V              | -                      | -                  | 0.6                    | -                      | 0.8                    | V    |
|                 |                           | I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V             | -                      | -                  | 0.4                    | -                      | 0.6                    | V    |
|                 |                           | I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V             | -                      | -                  | 0.55                   | -                      | 0.8                    | V    |
| I <sub>I</sub>  | input leakage current     | V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = 5.5 V or GND      | -                      | ±0.1               | ±5                     | -                      | ±20                    | μA   |

**Table 6.** Static characteristics ...continued

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

| Symbol           | Parameter                 | Conditions                                                                                                       | –40 °C to +85 °C |                    |     | –40 °C to +125 °C |      | Unit |
|------------------|---------------------------|------------------------------------------------------------------------------------------------------------------|------------------|--------------------|-----|-------------------|------|------|
|                  |                           |                                                                                                                  | Min              | Typ <sup>[1]</sup> | Max | Min               | Max  |      |
| I <sub>OFF</sub> | power-off leakage current | V <sub>CC</sub> = 0 V; V <sub>I</sub> or V <sub>O</sub> = 5.5 V                                                  | -                | 0.1                | 10  | -                 | 20   | μA   |
| I <sub>CC</sub>  | supply current            | V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A                           | -                | 0.1                | 10  | -                 | 40   | μA   |
| ΔI <sub>CC</sub> | additional supply current | per input pin; V <sub>CC</sub> = 1.65 V to 3.6 V; V <sub>I</sub> = V <sub>CC</sub> – 0.6 V; I <sub>O</sub> = 0 A | -                | 5                  | 500 | -                 | 5000 | μA   |
| C <sub>I</sub>   | input capacitance         | V <sub>CC</sub> = 0 V to 3.6 V; V <sub>I</sub> = GND to V <sub>CC</sub>                                          | -                | 5.0                | -   | -                 | -    | pF   |

[1] All typical values are measured at V<sub>CC</sub> = 3.3 V (unless stated otherwise) and T<sub>amb</sub> = 25 °C.

## 11. Dynamic characteristics

**Table 7.** Dynamic characteristicsVoltages are referenced to GND (ground = 0 V). For test circuit see [Figure 13](#).

| Symbol          | Parameter         | Conditions                                               | –40 °C to +85 °C |                    |      | –40 °C to +125 °C |      | Unit |
|-----------------|-------------------|----------------------------------------------------------|------------------|--------------------|------|-------------------|------|------|
|                 |                   |                                                          | Min              | Typ <sup>[1]</sup> | Max  | Min               | Max  |      |
| t <sub>pd</sub> | propagation delay | SHCP to Q7S; see <a href="#">Figure 7</a> <sup>[2]</sup> |                  |                    |      |                   |      |      |
|                 |                   | V <sub>CC</sub> = 1.2 V                                  | -                | 17.5               | -    | -                 | -    | ns   |
|                 |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                       | 2.0              | 5.2                | 15.8 | 2.0               | 18.2 | ns   |
|                 |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                         | 1.5              | 3.2                | 8.1  | 1.5               | 9.3  | ns   |
|                 |                   | V <sub>CC</sub> = 2.7 V                                  | 1.5              | 3.5                | 7.6  | 1.5               | 8.7  | ns   |
|                 |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                         | 1.5              | 3.1                | 6.7  | 1.5               | 7.7  | ns   |
|                 |                   | STCP to Qn; see <a href="#">Figure 8</a> <sup>[2]</sup>  |                  |                    |      |                   |      |      |
|                 |                   | V <sub>CC</sub> = 1.2 V                                  | -                | 19.3               | -    | -                 | -    | ns   |
|                 |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                       | 2.0              | 7.6                | 15.8 | 2.0               | 18.2 | ns   |
|                 |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                         | 1.5              | 4.8                | 8.1  | 1.5               | 9.3  | ns   |
|                 |                   | V <sub>CC</sub> = 2.7 V                                  | 1.5              | 5.2                | 7.6  | 1.5               | 8.7  | ns   |
|                 |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                         | 1.2              | 4.5                | 6.7  | 1.2               | 7.7  | ns   |

**Table 7. Dynamic characteristics ...continued**Voltages are referenced to GND (ground = 0 V). For test circuit see [Figure 13](#).

| Symbol           | Parameter                     | Conditions                                                                        | –40 °C to +85 °C |                    |      | –40 °C to +125 °C |      | Unit |
|------------------|-------------------------------|-----------------------------------------------------------------------------------|------------------|--------------------|------|-------------------|------|------|
|                  |                               |                                                                                   | Min              | Typ <sup>[1]</sup> | Max  | Min               | Max  |      |
| t <sub>PHL</sub> | HIGH to LOW propagation delay | SHR to Q7S; see <a href="#">Figure 11</a>                                         |                  |                    |      |                   |      |      |
|                  |                               | V <sub>CC</sub> = 1.2 V                                                           | -                | 12.0               | -    | -                 | -    | ns   |
|                  |                               | V <sub>CC</sub> = 1.65 V to 1.95 V                                                | 2.0              | 5.0                | 15.8 | 2.0               | 18.2 | ns   |
|                  |                               | V <sub>CC</sub> = 2.3 V to 2.7 V                                                  | 1.5              | 3.8                | 8.1  | 1.5               | 9.3  | ns   |
|                  |                               | V <sub>CC</sub> = 2.7 V                                                           | 1.2              | 3.9                | 7.6  | 1.2               | 8.7  | ns   |
|                  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                                  | 1.2              | 3.3                | 6.7  | 1.2               | 7.7  | ns   |
|                  |                               | STR to Qn; see <a href="#">Figure 12</a>                                          |                  |                    |      |                   |      |      |
|                  |                               | V <sub>CC</sub> = 1.2 V                                                           | -                | 20.0               | -    | -                 | -    | ns   |
|                  |                               | V <sub>CC</sub> = 1.65 V to 1.95 V                                                | 2.0              | 7.7                | 15.8 | 2.0               | 18.2 | ns   |
|                  |                               | V <sub>CC</sub> = 2.3 V to 2.7 V                                                  | 1.5              | 5.0                | 8.1  | 1.5               | 9.3  | ns   |
|                  |                               | V <sub>CC</sub> = 2.7 V                                                           | 1.2              | 5.3                | 7.6  | 1.2               | 8.7  | ns   |
|                  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                                  | 1.2              | 4.4                | 6.7  | 1.2               | 7.7  | ns   |
| t <sub>W</sub>   | pulse width                   | SHCP, STCP HIGH or LOW; see <a href="#">Figure 7</a> and <a href="#">Figure 8</a> |                  |                    |      |                   |      |      |
|                  |                               | V <sub>CC</sub> = 1.65 V to 1.95 V                                                | 6.0              | 2.5                | -    | 7.0               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 2.3 V to 2.7 V                                                  | 5.0              | 2.0                | -    | 5.5               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 2.7 V                                                           | 4.5              | 1.5                | -    | 5.0               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                                  | 4.0              | 1.5                | -    | 4.5               | -    | ns   |
|                  |                               | SHR, STR LOW; see <a href="#">Figure 11</a> and <a href="#">Figure 12</a>         |                  |                    |      |                   |      |      |
|                  |                               | V <sub>CC</sub> = 1.65 V to 1.95 V                                                | 6.0              | 2.5                | -    | 5.5               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 2.3 V to 2.7 V                                                  | 4.0              | 2.0                | -    | 4.5               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 2.7 V                                                           | 2.5              | 1.5                | -    | 3.0               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                                  | 2.5              | 1.5                | -    | 3.0               | -    | ns   |
| t <sub>SU</sub>  | set-up time                   | DS to SHCP; see <a href="#">Figure 9</a>                                          |                  |                    |      |                   |      |      |
|                  |                               | V <sub>CC</sub> = 1.65 V to 1.95 V                                                | 5.0              | 1.0                | -    | 5.5               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 2.3 V to 2.7 V                                                  | 4.0              | 0.8                | -    | 4.5               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 2.7 V                                                           | 2.0              | 0.6                | -    | 2.5               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                                  | 2.0              | 0.6                | -    | 2.5               | -    | ns   |
|                  |                               | SHR to STCP; see <a href="#">Figure 10</a>                                        |                  |                    |      |                   |      |      |
|                  |                               | V <sub>CC</sub> = 1.65 V to 1.95 V                                                | 8.0              | 3.5                | -    | 8.5               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 2.3 V to 2.7 V                                                  | 5.0              | 2.1                | -    | 5.5               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 2.7 V                                                           | 4.0              | 1.8                | -    | 4.5               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                                  | 4.0              | 1.7                | -    | 4.5               | -    | ns   |
|                  |                               | SHCP to STCP; see <a href="#">Figure 8</a>                                        |                  |                    |      |                   |      |      |
|                  |                               | V <sub>CC</sub> = 1.65 V to 1.95 V                                                | 8.0              | 3.5                | -    | 8.5               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 2.3 V to 2.7 V                                                  | 5.0              | 2.1                | -    | 5.5               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 2.7 V                                                           | 4.0              | 1.8                | -    | 4.5               | -    | ns   |
|                  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                                  | 4.0              | 1.7                | -    | 4.5               | -    | ns   |



**Table 7. Dynamic characteristics ...continued**

Voltages are referenced to GND (ground = 0 V). For test circuit see [Figure 13](#).

| Symbol             | Parameter                     | Conditions                                                                            | –40 °C to +85 °C |                    |     | –40 °C to +125 °C |     | Unit |
|--------------------|-------------------------------|---------------------------------------------------------------------------------------|------------------|--------------------|-----|-------------------|-----|------|
|                    |                               |                                                                                       | Min              | Typ <sup>[1]</sup> | Max | Min               | Max |      |
| t <sub>h</sub>     | hold time                     | DS to SHCP; see <a href="#">Figure 9</a>                                              |                  |                    |     |                   |     |      |
|                    |                               | V <sub>CC</sub> = 1.65 V to 1.95 V                                                    | 1.5              | 0.2                | -   | 2.0               | -   | ns   |
|                    |                               | V <sub>CC</sub> = 2.3 V to 2.7 V                                                      | 1.5              | 0.1                | -   | 2.0               | -   | ns   |
|                    |                               | V <sub>CC</sub> = 2.7 V                                                               | 1.5              | –0.1               | -   | 2.0               | -   | ns   |
|                    |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                                      | 1.0              | –0.2               | -   | 1.5               | -   | ns   |
| t <sub>rec</sub>   | recovery time                 | SHR to SHCP, STR to STCP; see <a href="#">Figure 11</a> and <a href="#">Figure 12</a> |                  |                    |     |                   |     |      |
|                    |                               | V <sub>CC</sub> = 1.65 V to 1.95 V                                                    | 5.0              | –2.7               | -   | 5.5               | -   | ns   |
|                    |                               | V <sub>CC</sub> = 2.3 V to 2.7 V                                                      | 4.0              | –1.5               | -   | 4.5               | -   | ns   |
|                    |                               | V <sub>CC</sub> = 2.7 V                                                               | 2.0              | –1.0               | -   | 2.5               | -   | ns   |
|                    |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                                      | 2.0              | –1.0               | -   | 2.5               | -   | ns   |
| f <sub>max</sub>   | maximum frequency             | SHCP or STCP; see <a href="#">Figure 7</a> and <a href="#">Figure 8</a>               |                  |                    |     |                   |     |      |
|                    |                               | V <sub>CC</sub> = 1.65 V to 1.95 V                                                    | 80               | 130                | -   | 70                | -   | MHz  |
|                    |                               | V <sub>CC</sub> = 2.3 V to 2.7 V                                                      | 100              | 140                | -   | 90                | -   | MHz  |
|                    |                               | V <sub>CC</sub> = 2.7 V                                                               | 110              | 150                | -   | 100               | -   | MHz  |
|                    |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                                      | 130              | 180                | -   | 115               | -   | MHz  |
| t <sub>sk(o)</sub> | output skew time              | V <sub>CC</sub> = 3.0 V to 3.6 V <a href="#">[3]</a>                                  | -                | -                  | 1.0 | -                 | 1.5 | ns   |
| C <sub>PD</sub>    | power dissipation capacitance | V <sub>I</sub> = GND to V <sub>CC</sub> <a href="#">[4]</a>                           |                  |                    |     |                   |     |      |
|                    |                               | V <sub>CC</sub> = 1.65 V to 1.95 V                                                    | -                | 50                 | -   | -                 | -   | pF   |
|                    |                               | V <sub>CC</sub> = 2.3 V to 2.7 V                                                      | -                | 45                 | -   | -                 | -   | pF   |
|                    |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                                      | -                | 44                 | -   | -                 | -   | pF   |

[1] Typical values are measured at T<sub>amb</sub> = 25 °C and V<sub>CC</sub> = 1.8 V, 2.5 V, 2.7 V, and 3.3 V respectively.

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

[3] Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.

[4] 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;

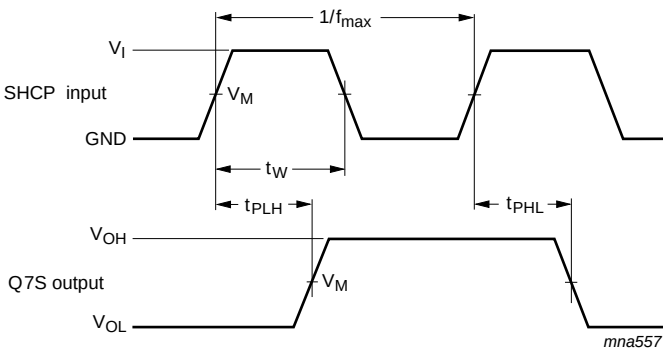
C<sub>L</sub> = output load capacitance in pF;

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

N = number of inputs switching;

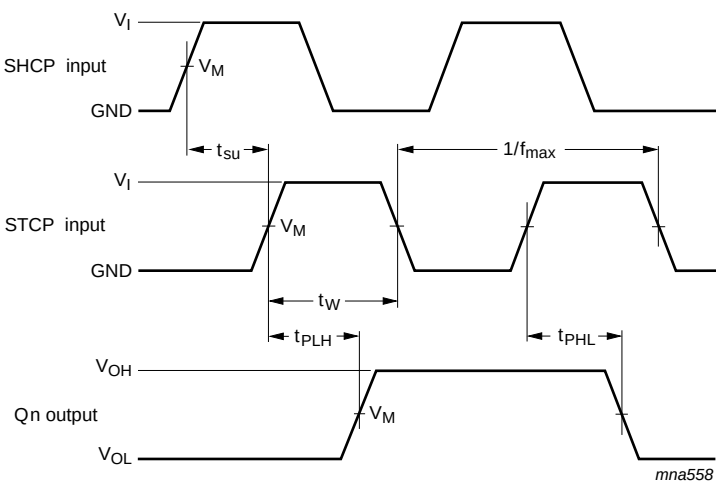
$\sum (C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.

12. Waveforms



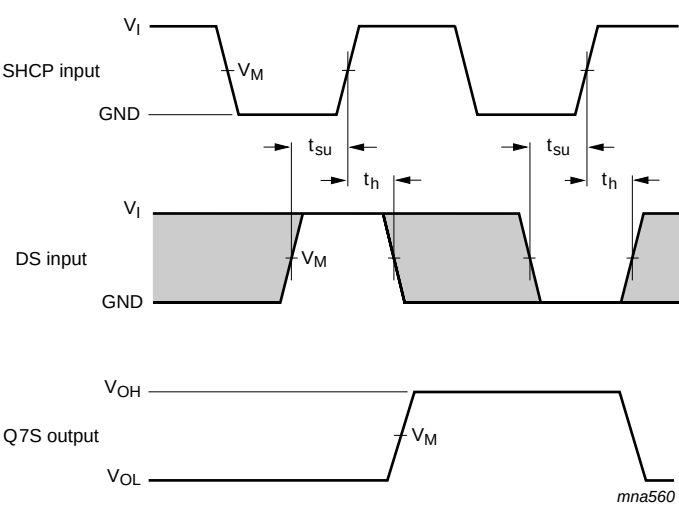
Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage drops that occur with the output load.

**Fig 7.** The shift clock (SHCP) to serial data output (Q7S) propagation delays, the shift clock pulse width and maximum shift clock frequency



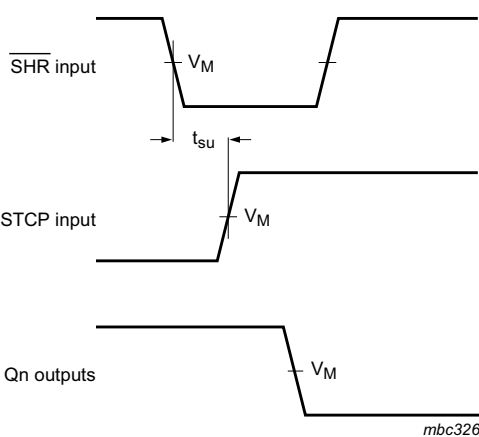
Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage drops that occur with the output load.

**Fig 8.** The storage clock (STCP) to parallel data output (Qn) propagation delays, the storage clock pulse width and the shift clock to storage clock set-up time



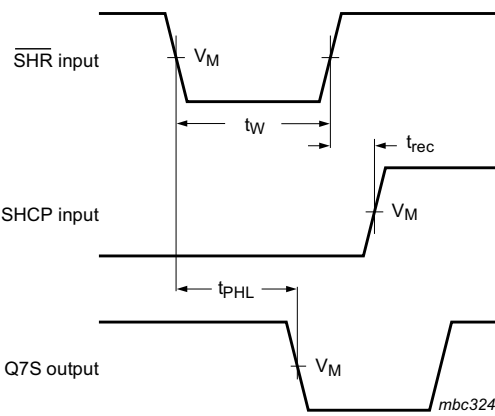
Measurement points are given in [Table 8](#).  
The shaded areas indicate when the input is permitted to change for predictable output performance.  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage drops that occur with the output load.

Fig 9. The data set-up and hold times for the serial data input (DS)



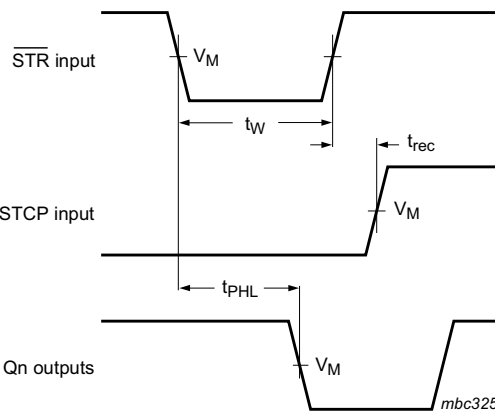
Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage drops that occur with the output load.

Fig 10. The shift reset (SHR) to storage clock (STCP) set-up times



Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage drops that occur with the output load.

**Fig 11.** The shift reset (SHR) pulse width, the shift reset to serial data output (Q7S) propagation delays and the shift reset to shift clock (SHCP) recovery time

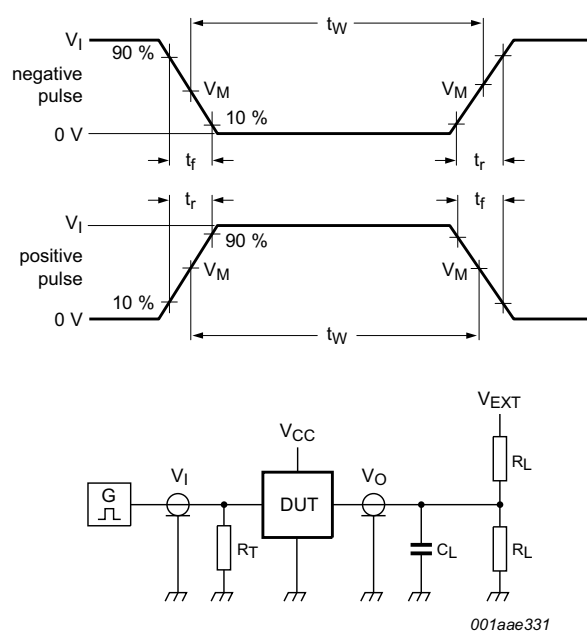


Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage drops that occur with the output load.

**Fig 12.** The storage reset (STR) pulse width, the storage reset to parallel data output (Qn) propagation delays and the storage reset to storage clock (STCP) recovery time

**Table 8.** Measurement points

| Supply voltage             | Input               | Output              |
|----------------------------|---------------------|---------------------|
| $V_{CC}$                   | $V_M$               | $V_M$               |
| $V_{CC} < 2.7\text{ V}$    | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |
| $V_{CC} \geq 2.7\text{ V}$ | 1.5 V               | 1.5 V               |



Test data is given in [Table 9](#). Definitions for test circuit:  
 $R_L$  = Load resistance.  
 $C_L$  = Load capacitance including jig and probe capacitance.  
 $R_T$  = Termination resistance should be equal to output impedance  $Z_o$  of the pulse generator.  
 $V_{EXT}$  = External voltage for measuring switching times.

Fig 13. Test circuit for measuring switching times

Table 9. Test data

| Supply voltage   | Input    |               | Load  |              | $V_{EXT}$          |                    |                    |
|------------------|----------|---------------|-------|--------------|--------------------|--------------------|--------------------|
|                  | $V_I$    | $t_r, t_f$    | $C_L$ | $R_L$        | $t_{PLH}, t_{PHL}$ | $t_{PLZ}, t_{PZL}$ | $t_{PHZ}, t_{PZH}$ |
| 1.2 V            | $V_{CC}$ | $\leq 2$ ns   | 30 pF | 1 k $\Omega$ | open               | $2 \times V_{CC}$  | GND                |
| 1.65 V to 1.95 V | $V_{CC}$ | $\leq 2$ ns   | 30 pF | 1 k $\Omega$ | open               | $2 \times V_{CC}$  | GND                |
| 2.3 V to 2.7 V   | $V_{CC}$ | $\leq 2$ ns   | 30 pF | 500 $\Omega$ | open               | $2 \times V_{CC}$  | GND                |
| 2.7 V            | 2.7 V    | $\leq 2.5$ ns | 50 pF | 500 $\Omega$ | open               | $2 \times V_{CC}$  | GND                |
| 3.0 V to 3.6 V   | 2.7 V    | $\leq 2.5$ ns | 50 pF | 500 $\Omega$ | open               | $2 \times V_{CC}$  | GND                |

13. Package outline

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

SOT109-1

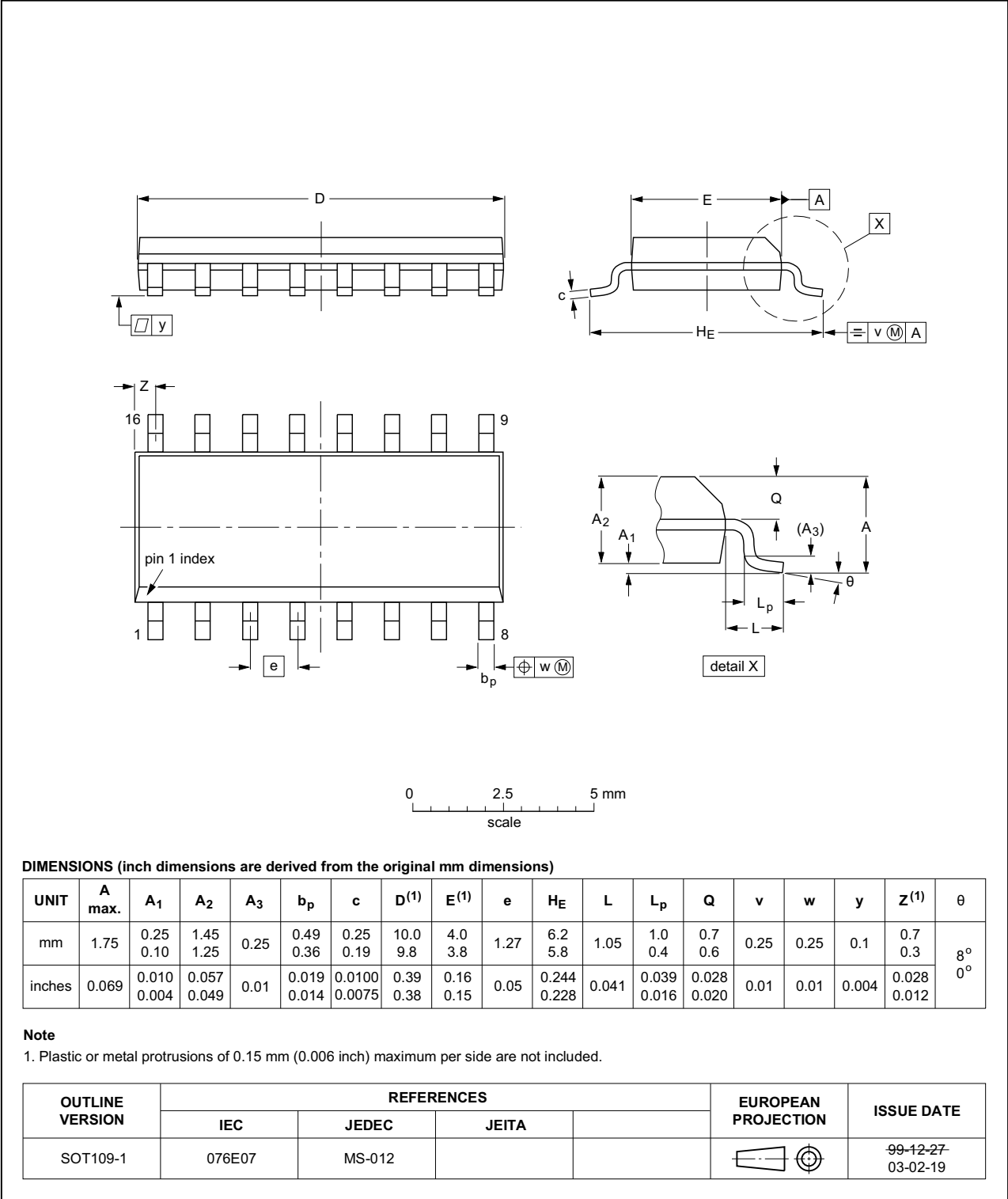


Fig 14. Package outline SOT109-1 (SO16)

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

SOT403-1

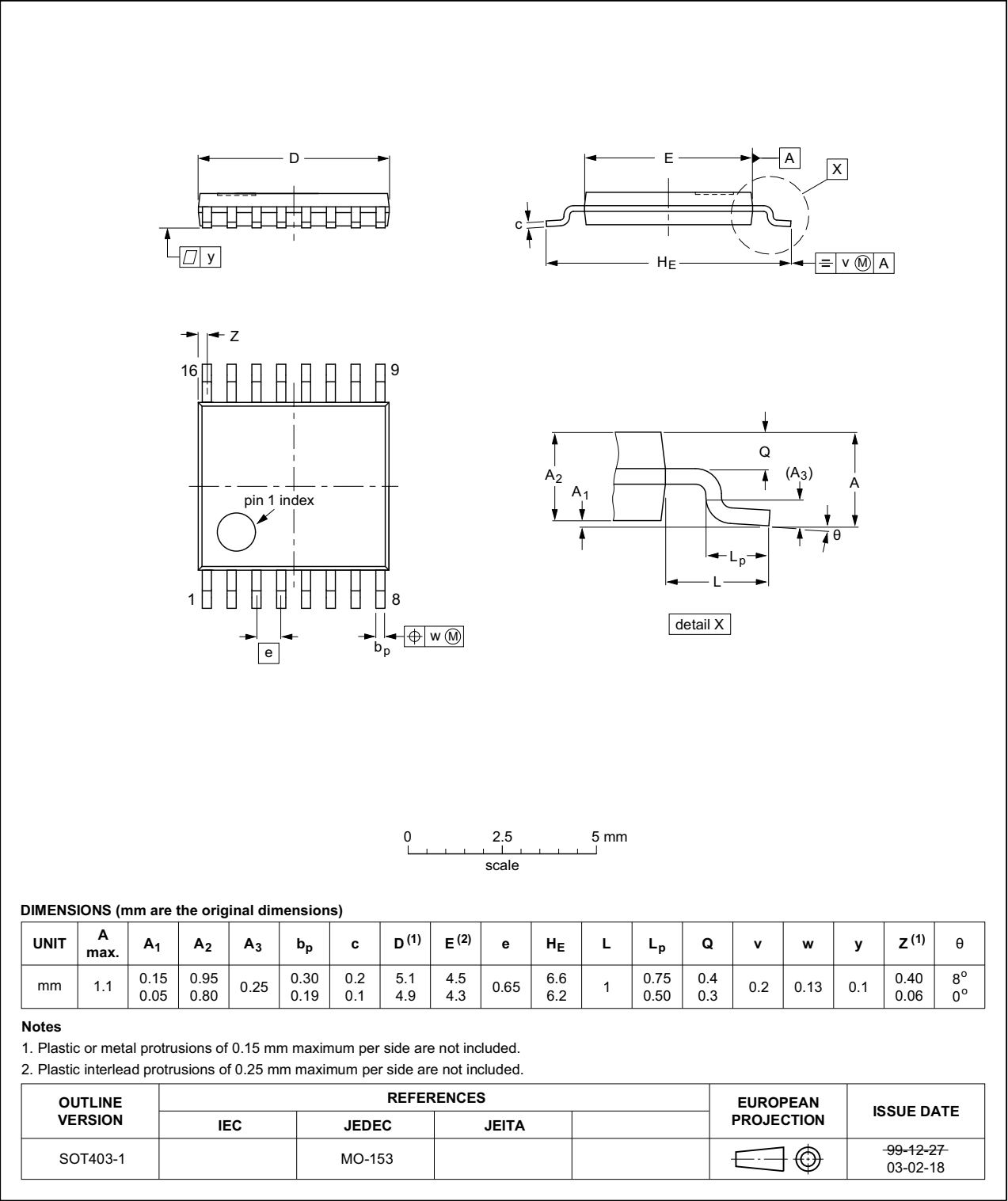


Fig 15. Package outline SOT403-1 (TSSOP16)

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

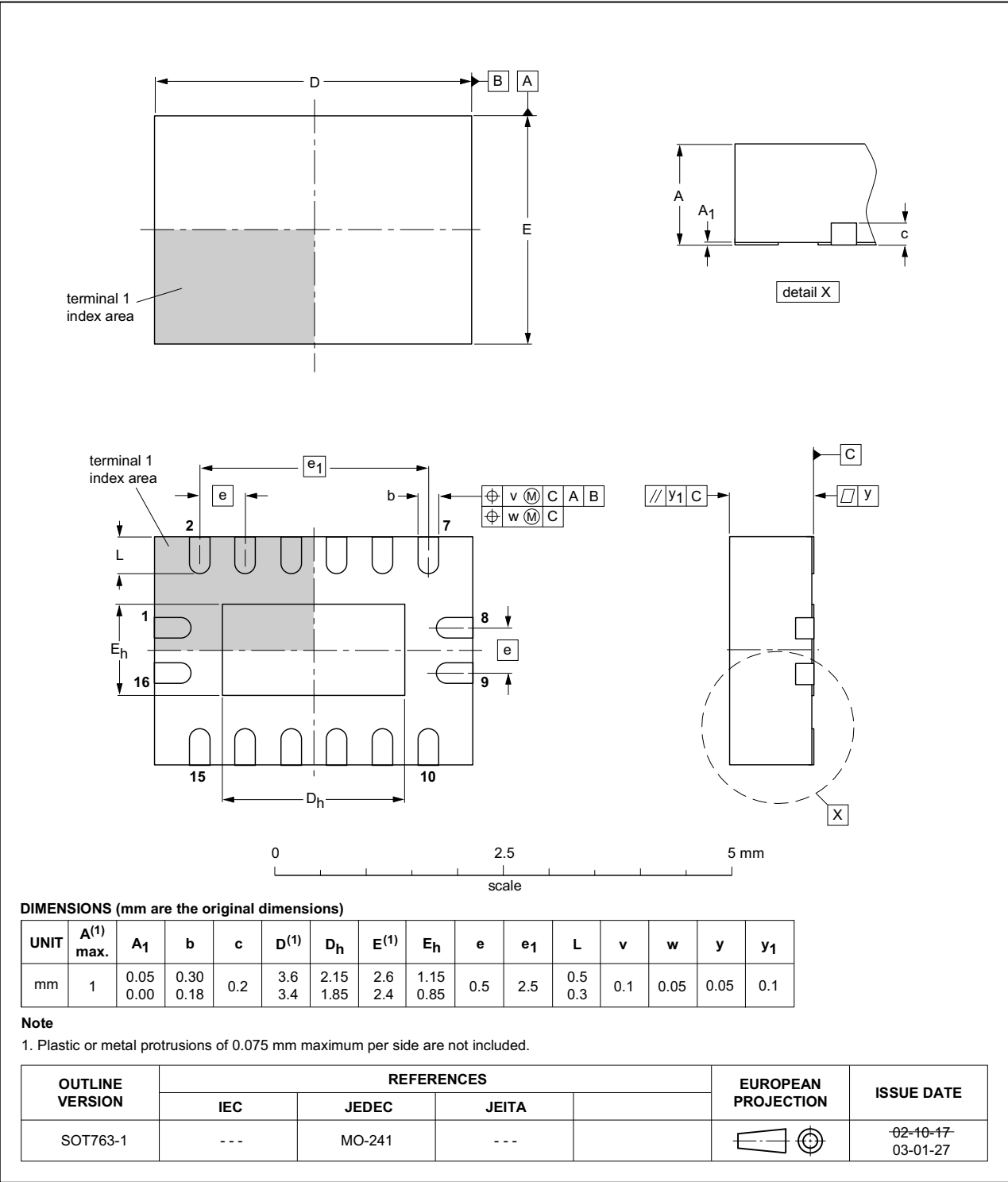


Fig 16. Package outline SOT763-1 (DHVQFN16)



## 14. 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                        |
| TTL     | Transistor-Transistor Logic             |

## 15. Revision history

Table 11. Revision history

| Document ID    | Release date                                                                                                                                                                                                                                         | Data sheet status  | Change notice | Supersedes    |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------|---------------|
| 74LVC594A v.2  | 20131021                                                                                                                                                                                                                                             | Product data sheet | -             | 74LVC594A 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></ul> |                    |               |               |
| 74LVC594A v.1  | 20070524                                                                                                                                                                                                                                             | Product data sheet | -             | -             |

## 16. Legal information

### 16.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | Definition                                                                            |
|-----------------------------------|-------------------------------|---------------------------------------------------------------------------------------|
| Objective [short] data sheet      | Development                   | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet    | Qualification                 | This document contains data from the preliminary specification.                       |
| Product [short] data sheet        | Production                    | This document contains the product specification.                                     |

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

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