

# 74HC594; 74HCT594

## 8-bit shift register with output register

Rev. 4 — 25 February 2016

Product data sheet

### 1. General description

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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

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- 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

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



## 4. Ordering information

Table 1. Ordering information

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

## 5. Functional diagram

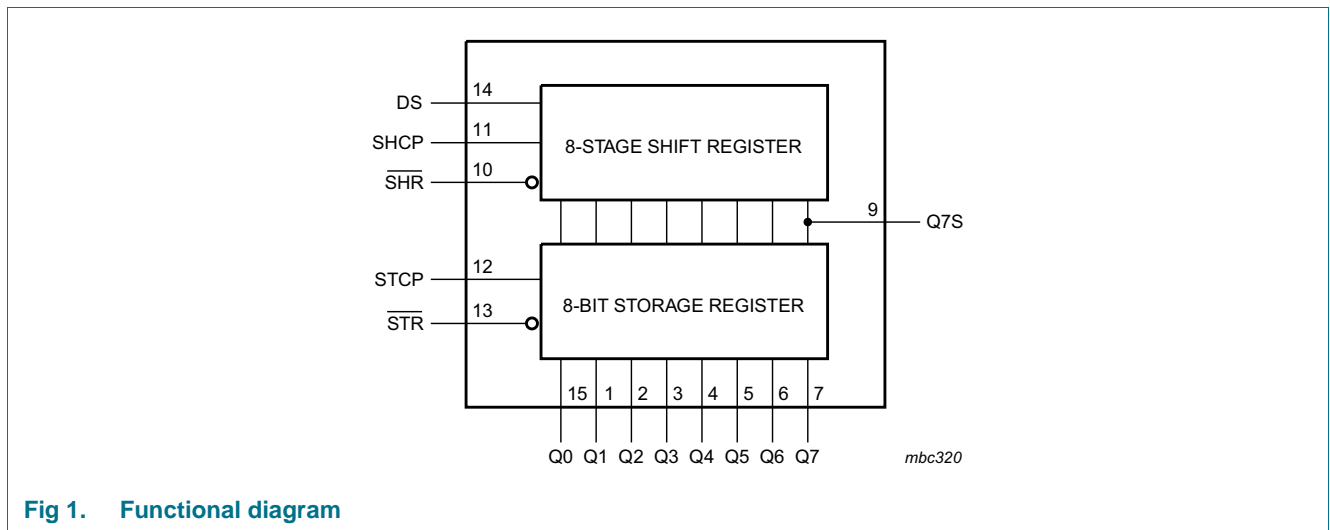


Fig 1. Functional diagram

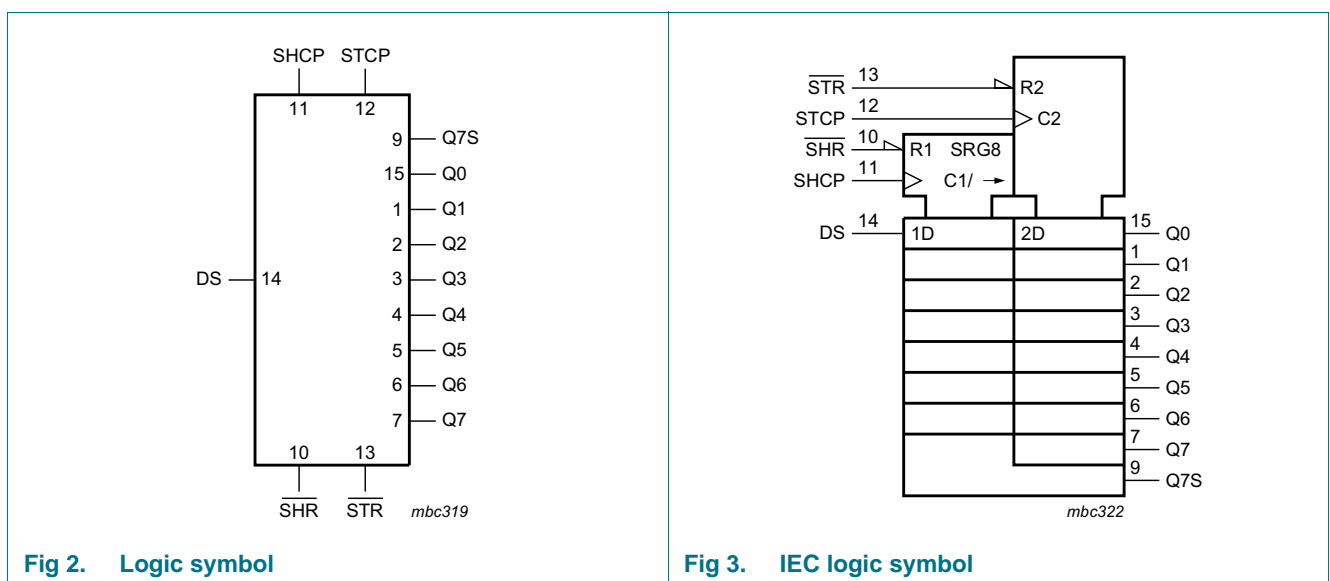


Fig 2. Logic symbol

Fig 3. IEC logic symbol

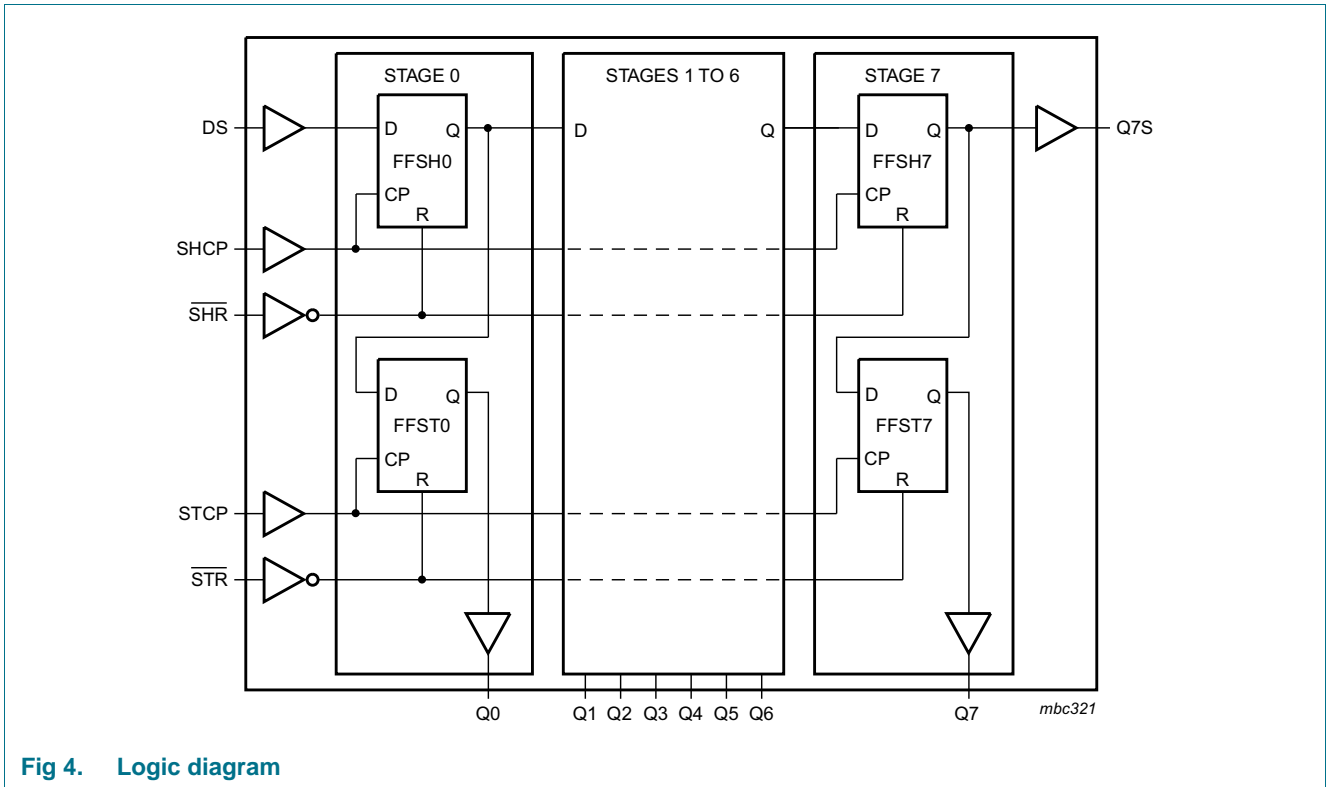


Fig 4. Logic diagram

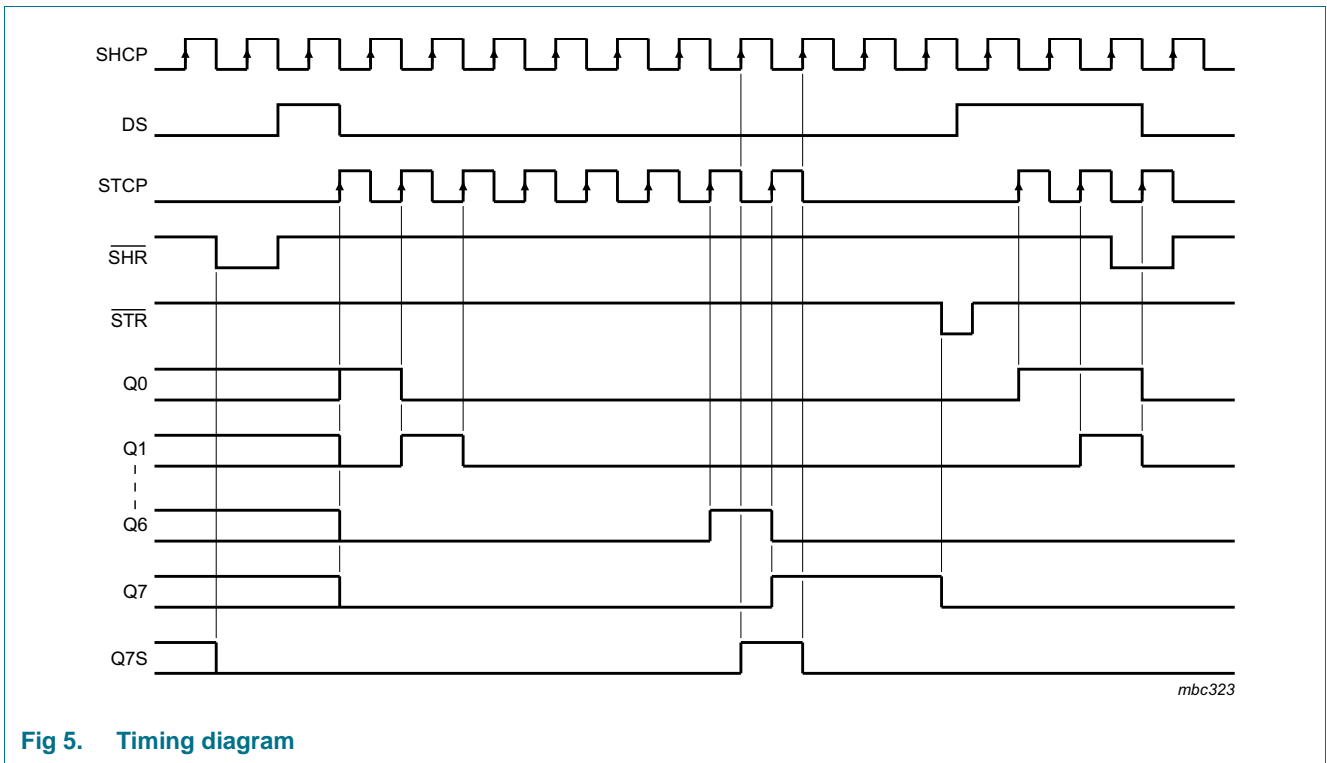
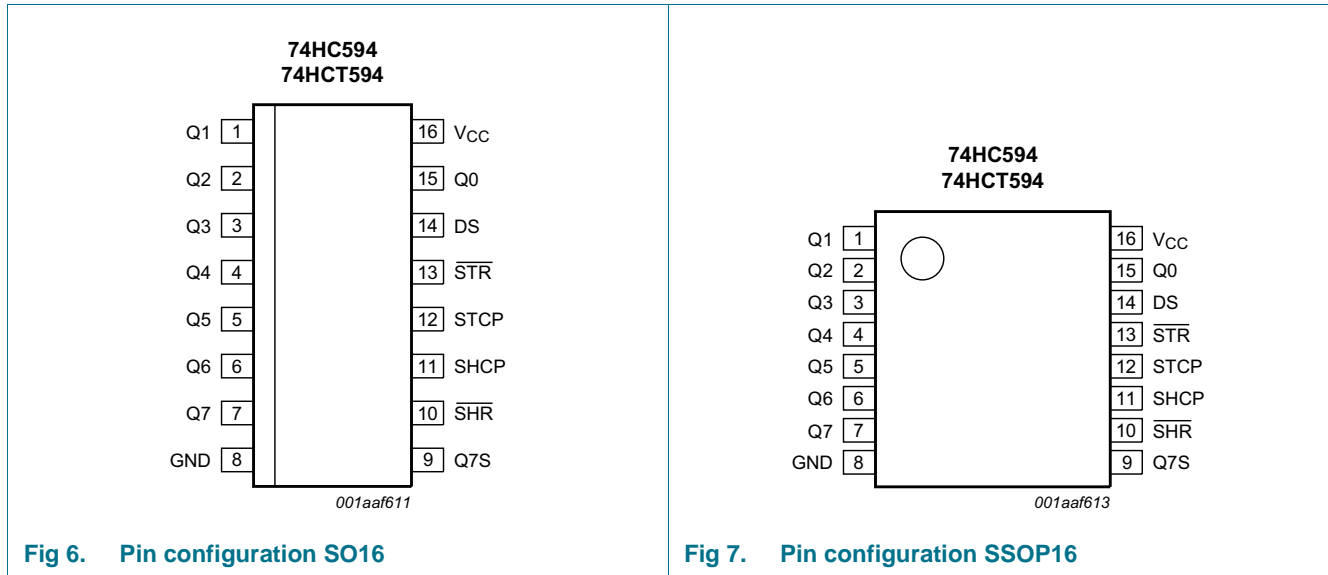


Fig 5. Timing diagram

## 6. Pinning information

### 6.1 Pinning



### 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>

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 <sub>CC</sub>	supply voltage		-0.5	+7.0	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < -0.5 V or V <sub>I</sub> > V <sub>CC</sub> + 0.5 V <sup>[1]</sup>	-	±20	mA
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < -0.5 V or V <sub>O</sub> > V <sub>CC</sub> + 0.5 V <sup>[1]</sup>	-	±20	mA
I <sub>O</sub>	output current	V <sub>O</sub> = -0.5 V to V <sub>CC</sub> + 0.5 V			
		Serial data output Q7S	-	±25	mA
		Parallel data output	-	±35	mA
I <sub>CC</sub>	supply current	Serial data output Q7S	-	50	mA
		Parallel data output	-	70	mA
I <sub>GND</sub>	ground current	Serial data output Q7S	-	-50	mA
		Parallel data output	-	-70	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -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<sub>tot</sub> derates linearly with 8 mW/K.  
 For SSOP16 packages: above 60 °C the value of P<sub>tot</sub> 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 <sub>CC</sub>	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
V <sub>I</sub>	input voltage		0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V
V <sub>O</sub>	output voltage		0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V
T <sub>amb</sub>	ambient temperature		-40	-	+125	-40	-	+125	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 2.0 V	-	-	625	-	-	-	ns/V
		V <sub>CC</sub> = 4.5 V	-	1.67	139	-	1.67	139	ns/V
		V <sub>CC</sub> = 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
<b>T<sub>amb</sub> = 25 °C</b>						
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 2.0 V	1.5	1.2	-	V
		V <sub>CC</sub> = 4.5 V	3.15	2.4	-	V
		V <sub>CC</sub> = 6.0 V	4.2	3.2	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 2.0 V	-	0.8	0.5	V
		V <sub>CC</sub> = 4.5 V	-	2.1	1.35	V
		V <sub>CC</sub> = 6.0 V	-	2.8	1.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		Serial data output Q7S				
		I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V	3.98	4.32	-	V
		I <sub>O</sub> = -5.2 mA; V <sub>CC</sub> = 6.0 V	5.48	5.81	-	V
		Parallel data outputs				
		I <sub>O</sub> = -6.0 mA; V <sub>CC</sub> = 4.5 V	3.98	4.32	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		Serial data output Q7S				
		I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.26	V
		I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V	-	0.16	0.26	V
		Parallel data outputs				
		I <sub>O</sub> = 6.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.26	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V	-	-	±0.1	μA
		V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 6.0 V	-	-	8.0	μA
C <sub>i</sub>	input capacitance		-	3.5	-	pF

**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
<b>T<sub>amb</sub> = -40 °C to +85 °C</b>						
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 2.0 V	1.5	-	-	V
		V <sub>CC</sub> = 4.5 V	3.15	-	-	V
		V <sub>CC</sub> = 6.0 V	4.2	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 2.0 V	-	-	0.5	V
		V <sub>CC</sub> = 4.5 V	-	-	1.35	V
		V <sub>CC</sub> = 6.0 V	-	-	1.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		Serial data output Q7S				
		I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V	3.84	-	-	V
		I <sub>O</sub> = -5.2 mA; V <sub>CC</sub> = 6.0 V	5.34	-	-	V
		Parallel data outputs				
		I <sub>O</sub> = -6.0 mA; V <sub>CC</sub> = 4.5 V	3.84	-	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		Serial data output Q7S				
		I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V	-	-	0.33	V
		I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V	-	-	0.33	V
		Parallel data outputs				
		I <sub>O</sub> = 6.0 mA; V <sub>CC</sub> = 4.5 V	-	-	0.33	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V	-	-	±1.0	μA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 6.0 V	-	-	80	μA
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>						
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 2.0 V	1.5	-	-	V
		V <sub>CC</sub> = 4.5 V	3.15	-	-	V
		V <sub>CC</sub> = 6.0 V	4.2	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 2.0 V	-	-	0.5	V
		V <sub>CC</sub> = 4.5 V	-	-	1.35	V
		V <sub>CC</sub> = 6.0 V	-	-	1.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		Serial data output Q7S				
		I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V	3.7	-	-	V
		I <sub>O</sub> = -5.2 mA; V <sub>CC</sub> = 6.0 V	5.2	-	-	V
		Parallel data outputs				
		I <sub>O</sub> = -6.0 mA; V <sub>CC</sub> = 4.5 V	3.7	-	-	V
		I <sub>O</sub> = -7.8 mA; V <sub>CC</sub> = 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 <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		Serial data output Q7S				
		I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V	-	-	0.4	V
		I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V	-	-	0.4	V
		Parallel data outputs				
		I <sub>O</sub> = 6.0 mA; V <sub>CC</sub> = 4.5 V	-	-	0.4	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V	-	-	±1.0	μA
		I <sub>O</sub> = 7.8 mA; V <sub>CC</sub> = 6.0 V	-	-	0.4	V
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 6.0 V	-	-	160	μA

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>T<sub>amb</sub> = 25 °C</b>						
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	1.6	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	-	1.2	0.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		Serial data output Q7S				
		I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V	3.98	4.32	-	V
		Parallel data outputs				
V <sub>OL</sub>	LOW-level output voltage	I <sub>O</sub> = -6.0 mA; V <sub>CC</sub> = 4.5 V	3.98	4.32	-	V
		V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		Serial data output Q7S				
		I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.26	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	-	-	±0.1	μA
		I <sub>O</sub> = 6.0 mA; V <sub>CC</sub> = 4.5 V	-	0.16	0.26	V
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	8.0	μA
ΔI <sub>CC</sub>	additional supply current	per input pin; V <sub>I</sub> = V <sub>CC</sub> - 2.1 V and other inputs at V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 4.5 V to 5.5 V				
		pins $\overline{\text{SHR}}$ , SHCP, STCP, $\overline{\text{STR}}$	-	150	540	μA
		pin DS	-	25	90	μA
C <sub>i</sub>	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
<b>T<sub>amb</sub> = -40 °C to +85 °C</b>						
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	0.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		Serial data output Q7S				
		I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V	3.84	-	-	V
		Parallel data outputs				
		I <sub>O</sub> = -6.0 mA; V <sub>CC</sub> = 4.5 V	3.84	-	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		Serial data output				
		I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V	-	-	0.33	V
		Parallel data outputs				
		I <sub>O</sub> = 6.0 mA; V <sub>CC</sub> = 4.5 V	-	-	0.33	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	-	-	±1.0	μA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	80	μA
ΔI <sub>CC</sub>	additional supply current	per input pin; V <sub>I</sub> = V <sub>CC</sub> - 2.1 V and other inputs at V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 4.5 V to 5.5 V				
		pins $\overline{\text{SHR}}$ , SHCP, STCP, $\overline{\text{STR}}$	-	-	675	μA
		pin DS	-	-	112.5	μA
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>						
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	0.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		Serial data output Q7S				
		I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V	3.7	-	-	V
		Parallel data outputs				
		I <sub>O</sub> = -6.0 mA; V <sub>CC</sub> = 4.5 V	3.7	-	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		Serial data output Q7S				
		I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V	-	-	0.4	V
		Parallel data outputs				
		I <sub>O</sub> = 6.0 mA; V <sub>CC</sub> = 4.5 V	-	-	0.4	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	-	-	±1.0	μA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	160	μA
ΔI <sub>CC</sub>	additional supply current	per input pin; V <sub>I</sub> = V <sub>CC</sub> - 2.1 V and other inputs at V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 4.5 V to 5.5 V				
		pins $\overline{\text{SHR}}$ , SHCP, STCP, $\overline{\text{STR}}$	-	-	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 <sub>pd</sub>	propagation delay	SHCP to Q7S; see <a href="#">Figure 8</a> [1]								
		V <sub>CC</sub> = 2.0 V	-	44	150	-	185	-	225	ns
		V <sub>CC</sub> = 4.5 V	-	16	30	-	37	-	45	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	13	-	-	-	-	-	ns
		V <sub>CC</sub> = 6.0 V	-	14	26	-	31	-	38	ns
		STCP to Qn; see <a href="#">Figure 9</a>								
		V <sub>CC</sub> = 2.0 V	-	44	150	-	185	-	225	ns
		V <sub>CC</sub> = 4.5 V	-	16	30	-	37	-	45	ns
t <sub>PHL</sub>	HIGH to LOW propagation delay	SHR to Q7S; see <a href="#">Figure 12</a>								
		V <sub>CC</sub> = 2.0 V	-	39	150	-	185	-	225	ns
		V <sub>CC</sub> = 4.5 V	-	14	30	-	37	-	45	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	11	-	-	-	-	-	ns
		V <sub>CC</sub> = 6.0 V	-	12	26	-	31	-	38	ns
		STR to Qn; see <a href="#">Figure 13</a>								
		V <sub>CC</sub> = 2.0 V	-	39	125	-	155	-	185	ns
		V <sub>CC</sub> = 4.5 V	-	14	25	-	31	-	37	ns
t <sub>THL</sub>	HIGH to LOW output transition time	Q7S; see <a href="#">Figure 8</a>								
		V <sub>CC</sub> = 2.0 V	-	19	75	-	95	-	110	ns
		V <sub>CC</sub> = 4.5 V	-	7	15	-	19	-	22	ns
		V <sub>CC</sub> = 6.0 V	-	6	13	-	16	-	19	ns
		Qn								
		V <sub>CC</sub> = 2.0 V	-	14	60	-	75	-	90	ns
		V <sub>CC</sub> = 4.5 V	-	5	12	-	15	-	18	ns
		V <sub>CC</sub> = 6.0 V	-	4	10	-	13	-	15	ns
t <sub>TLH</sub>	LOW to HIGH output transition time	Q7S; see <a href="#">Figure 8</a>								
		V <sub>CC</sub> = 2.0 V	-	19	75	-	95	-	110	ns
		V <sub>CC</sub> = 4.5 V	-	7	15	-	19	-	22	ns
		V <sub>CC</sub> = 6.0 V	-	6	13	-	16	-	19	ns
		Qn								
		V <sub>CC</sub> = 2.0 V	-	14	60	-	75	-	90	ns
		V <sub>CC</sub> = 4.5 V	-	5	12	-	15	-	18	ns
		V <sub>CC</sub> = 6.0 V	-	4	10	-	13	-	15	ns

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

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

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

$GND = 0\text{ V}$ ;  $t_r = t_f = 6\text{ ns}$ ;  $C_L = 50\text{ pF}$ ; 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	
f <sub>max</sub>	maximum frequency	SHCP or STCP; see <a href="#">Figure 8</a> and <a href="#">Figure 9</a>								
		V <sub>CC</sub> = 2.0 V	6.0	30	-	4.8	-	4.0	-	MHz
		V <sub>CC</sub> = 4.5 V	30	92	-	24	-	20	-	MHz
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	100	-	-	-	-	-	MHz
		V <sub>CC</sub> = 6.0 V	35	109	-	28	-	24	-	MHz
C <sub>PD</sub>	power dissipation capacitance	V <sub>I</sub> = GND to V <sub>CC</sub> ; V <sub>CC</sub> = 5 V; f <sub>i</sub> = 1 MHz <sup>[2]</sup>	-	84	-	-	-	-	-	pF

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

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

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

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

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

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

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

N = number of inputs switching;

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

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

$GND = 0\text{ V}$ ; V<sub>CC</sub> = 4.5 V; t<sub>r</sub> = t<sub>f</sub> = 6 ns; C<sub>L</sub> = 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 <sub>pd</sub>	propagation delay	SHCP to Q7S; see <a href="#">Figure 8</a> <sup>[1]</sup>	-	18	32	-	40	-	48	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	15	-	-	-	-	-	ns
		STCP to Qn; see <a href="#">Figure 9</a>	-	18	32	-	40	-	48	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	15	-	-	-	-	-	ns
t <sub>PHL</sub>	HIGH to LOW propagation delay	SHR to Q7S; see <a href="#">Figure 12</a>	-	17	30	-	38	-	45	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	14	-	-	-	-	-	ns
		STR to Qn; see <a href="#">Figure 13</a>	-	17	30	-	38	-	45	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	14	-	-	-	-	-	ns
t <sub>THL</sub>	HIGH to LOW output transition time	Q7S; see <a href="#">Figure 8</a>								
		V <sub>CC</sub> = 4.5 V	-	7	15	-	19	-	22	ns
		Qn								
		V <sub>CC</sub> = 4.5 V	-	5	12	-	15	-	18	ns
t <sub>TLH</sub>	LOW to HIGH output transition time	Q7S; see <a href="#">Figure 8</a>								
		V <sub>CC</sub> = 4.5 V	-	7	15	-	19	-	22	ns
		Qn								
		V <sub>CC</sub> = 4.5 V	-	5	12	-	15	-	18	ns

**Table 9. Dynamic characteristics type 74HCT594 ...continued**  
*GND = 0 V; V<sub>CC</sub> = 4.5 V; t<sub>r</sub> = t<sub>f</sub> = 6 ns; C<sub>L</sub> = 50 pF; 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 <sub>w</sub>	pulse width	SHCP (HIGH or LOW); see <a href="#">Figure 8</a>	16	4	-	20	-	24	-	ns
		STCP (HIGH or LOW); see <a href="#">Figure 9</a>	16	4	-	20	-	24	-	ns
		SHR and STR (HIGH or LOW); see <a href="#">Figure 12</a> and <a href="#">Figure 13</a>	16	6	-	20	-	24	-	ns
t <sub>su</sub>	set-up time	DS to SHCP; see <a href="#">Figure 10</a>	20	4	-	25	-	30	-	ns
		SHR to STCP; see <a href="#">Figure 11</a>	20	6	-	25	-	30	-	ns
		SHCP to STCP; see <a href="#">Figure 9</a>	20	7	-	25	-	30	-	ns
t <sub>h</sub>	hold time	DS to SHCP; see <a href="#">Figure 10</a>	5	-3	-	6	-	7	-	ns
t <sub>rec</sub>	recovery time	SHR to SHCP and STR to STCP; see <a href="#">Figure 12</a> and <a href="#">Figure 13</a>	10	-5	-	13	-	15	-	ns
f <sub>max</sub>	maximum frequency	SHCP or STCP; see <a href="#">Figure 8</a> and <a href="#">Figure 9</a>	30	92	-	24	-	20	-	MHz
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	100	-	-	-	-	-	MHz
C <sub>PD</sub>	power dissipation capacitance	V <sub>I</sub> = GND to V <sub>CC</sub> - 1.5 V; V <sub>CC</sub> = 5 V; f <sub>i</sub> = 1 MHz	[2]	-	89	-	-	-	-	pF

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

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

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

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

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

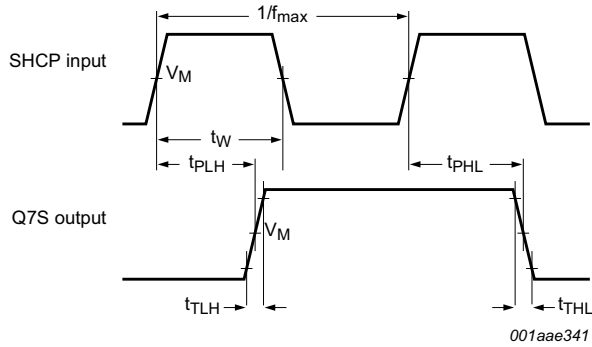
C<sub>L</sub> = output load capacitance in pF;

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

N = number of inputs switching;

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

## 12. Waveforms

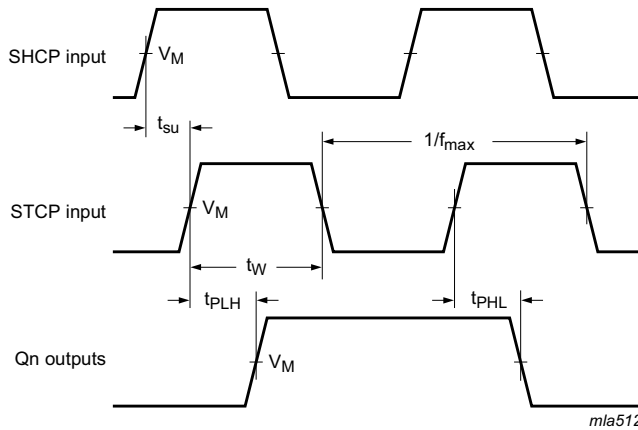


Measurement points are given in [Table 10](#).

$t_{PLH}$  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.

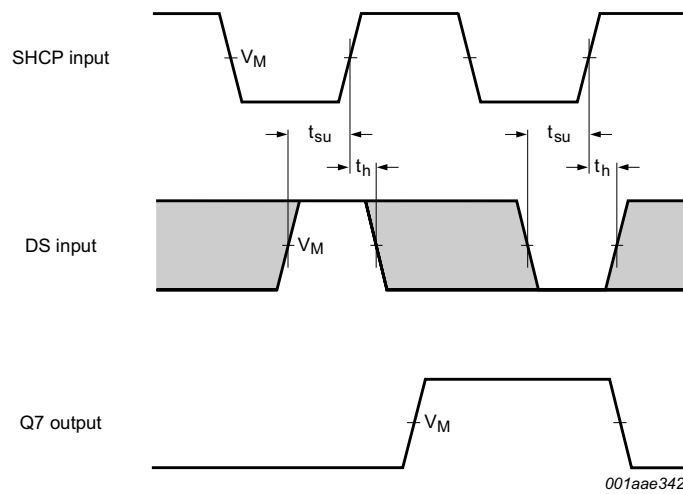
**Fig 8. The shift clock (SHCP) to output (Q7S) propagation delays, the shift clock pulse width, the maximum shift clock frequency, and output transition times**



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

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

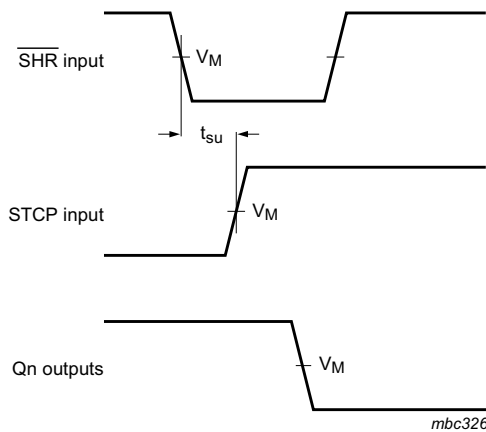
**Fig 9. The storage clock (STCP) to output (Qn), propagation delays, the storage clock pulse width, the maximum storage clock pulse frequency and the shift clock to storage clock set-up time**



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

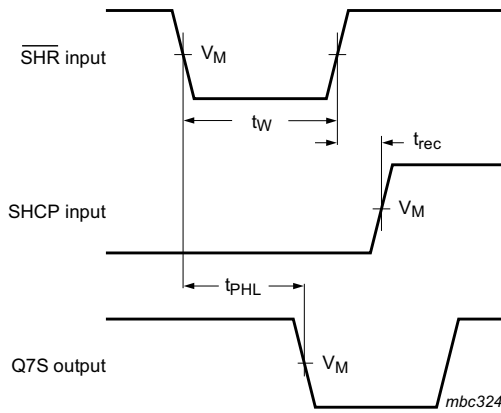
The shaded areas indicate when the input is permitted to change for predictable output performance.

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



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

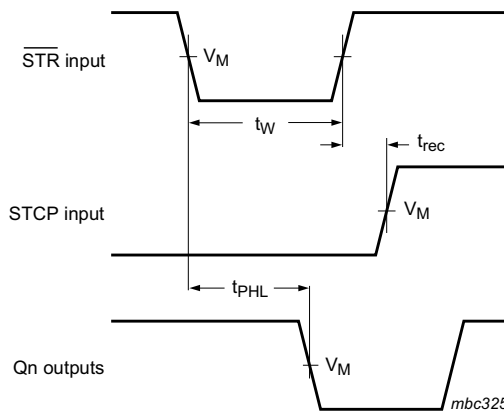
**Fig 11. The set-up time shift reset (SHR) to storage clock (STCP)**



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

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

**Fig 12. The shift reset (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 (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



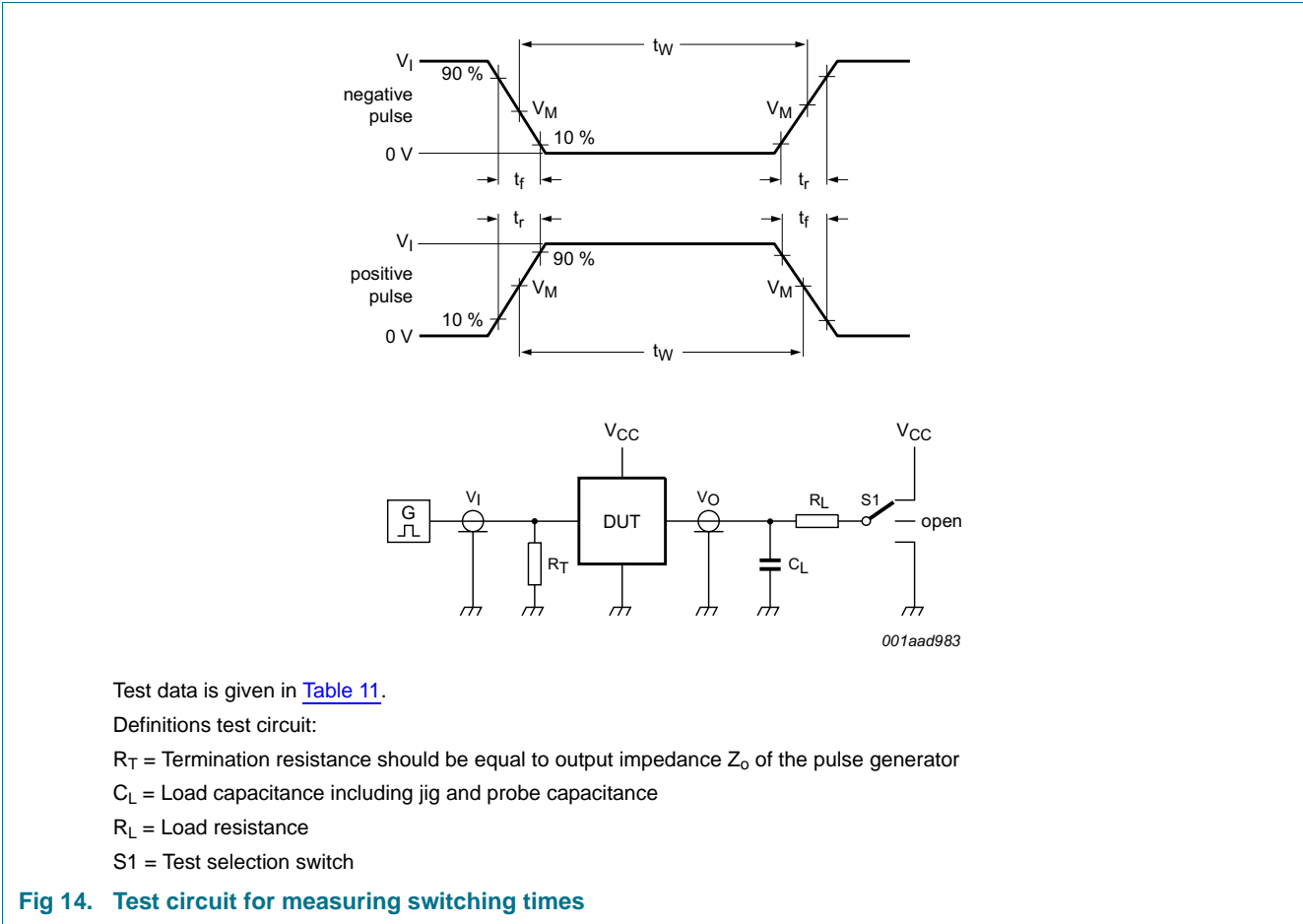


Table 11. Test data

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 $\Omega$	open	GND	$V_{CC}$
74HCT594	3 V	6 ns	15 pF, 50 pF	1 k $\Omega$	open	GND	$V_{CC}$

13. Package outline

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

SOT109-1

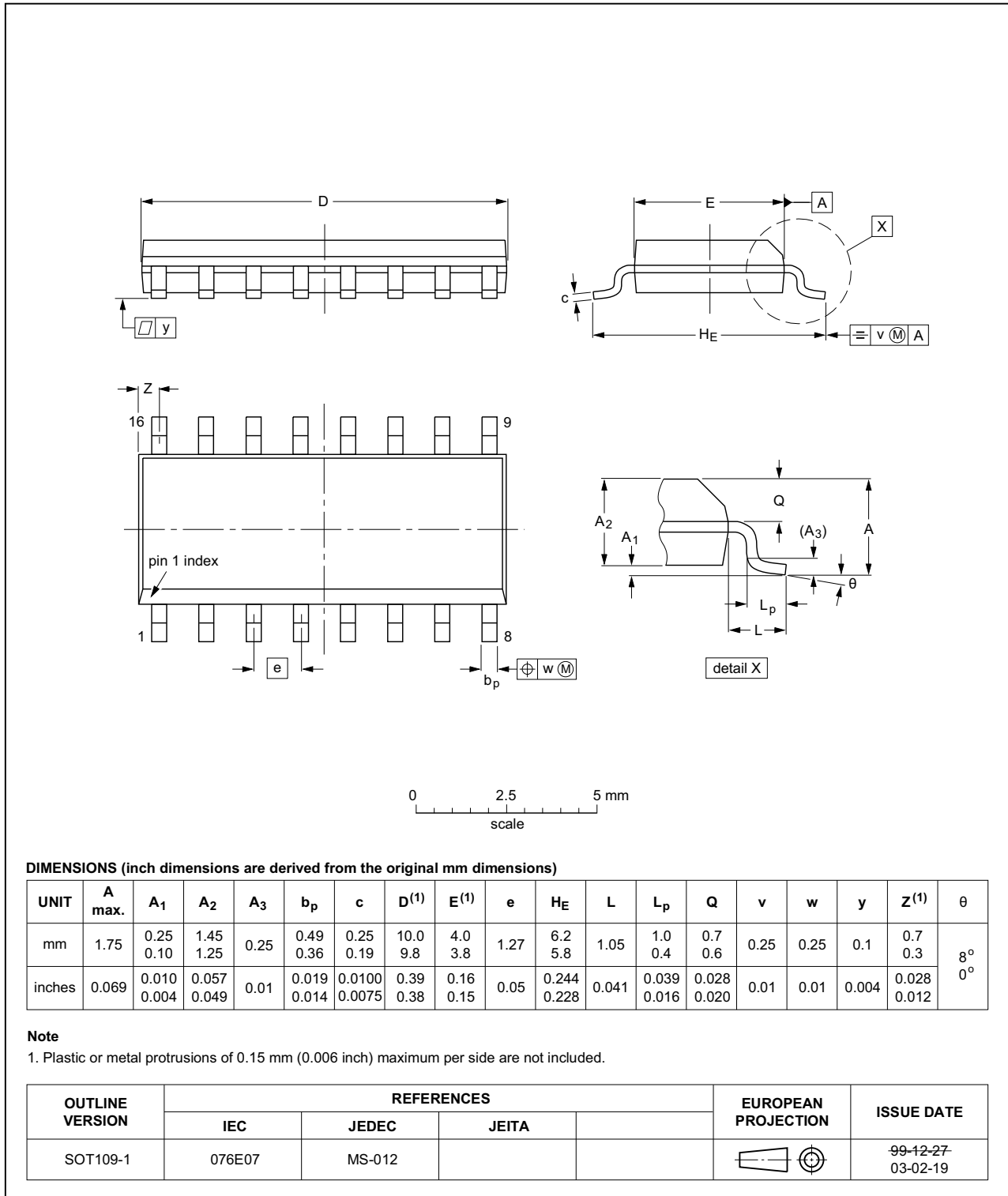


Fig 15. Package outline SOT109-1 (SO16)

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

SOT338-1

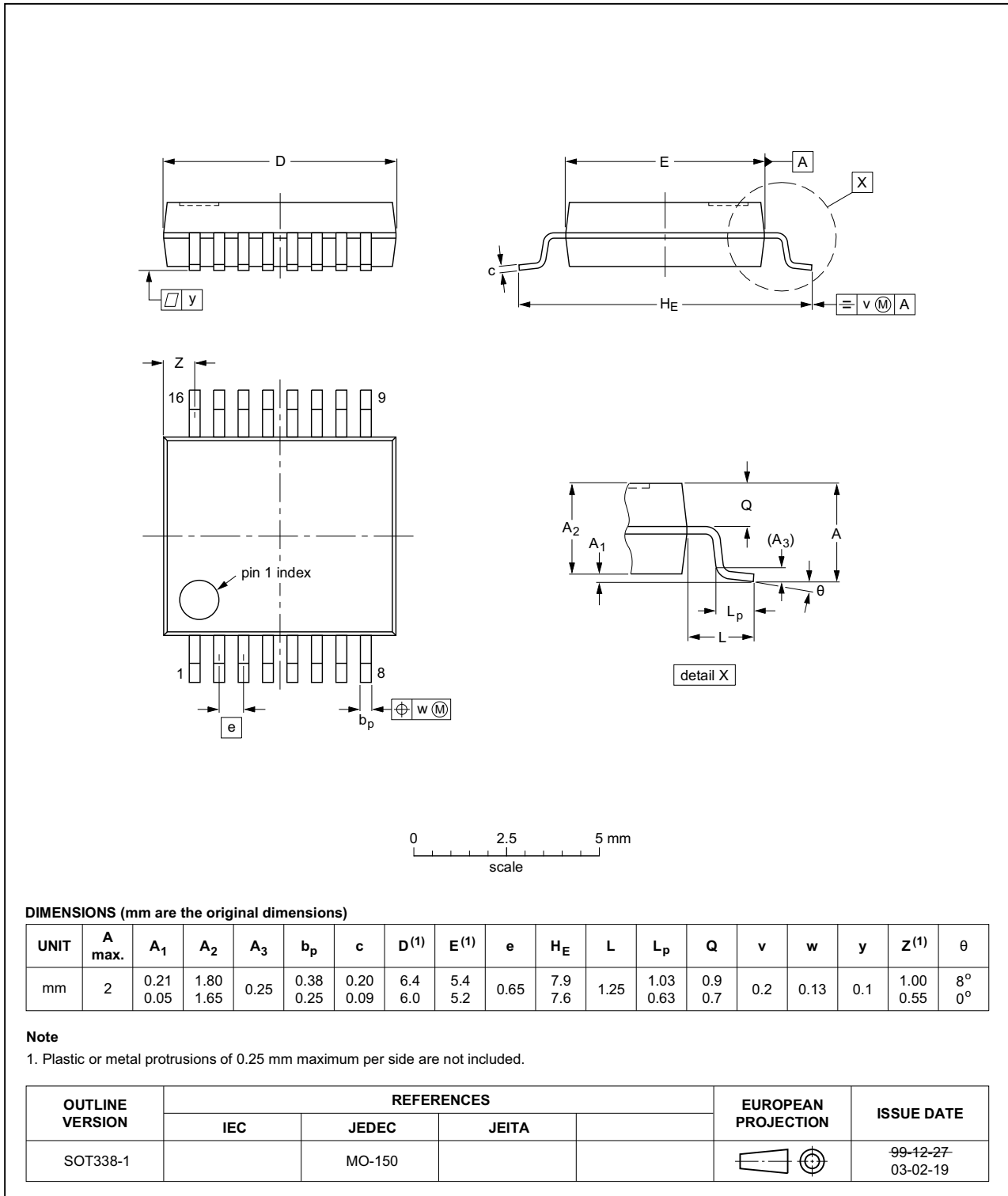


Fig 16. Package outline SOT338-1 (SSOP16)

## 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"> <li>Type numbers 74HC594N and 74HCT594N (SOT38-4) removed.</li> </ul>			
74HC_HCT594 v.3	20061220	Product data sheet	-	74HC_HCT594_CNV v.2
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 1 "Ordering information"</a> updated.</li> </ul>			
74HC_HCT594_CNV v.2	19970908	Product specification	-	74HC_HCT594_CNV v.1

## 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".

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