

# 74HC594-Q100; 74HCT594-Q100

## 8-bit shift register with output register

Rev. 1 — 2 August 2012

Product data sheet

### 1. General description

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The 74HC594-Q100; 74HCT594-Q100 is a high-speed Si-gate CMOS device and is pin compatible with Low-Power Schottky TTL (LSTTL).

The 74HC594-Q100; 74HCT594-Q100 is an 8-bit, non-inverting, serial-in, parallel-out shift register that feeds an 8-bit D-type storage register. Separate clocks (SHCP and STCP) and direct overriding clears ( $\overline{\text{SHR}}$  and  $\overline{\text{STR}}$ ) are provided on both the shift and storage registers. A serial output (Q7S) is provided for cascading purposes.

Both the shift and storage register clocks are positive-edge triggered. If both clocks are connected together, the shift register is always one count pulse ahead of the storage register.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

### 2. Features and benefits

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- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - ◆ Specified from  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  and from  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$
- 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)
- Multiple package options
- ESD protection:
  - ◆ MIL-STD-883, method 3015 exceeds 2000 V
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V (C = 200 pF, R = 0  $\Omega$ )

### 3. Applications

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



## 4. Ordering information

Table 1. Ordering information

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

## 5. Functional diagram

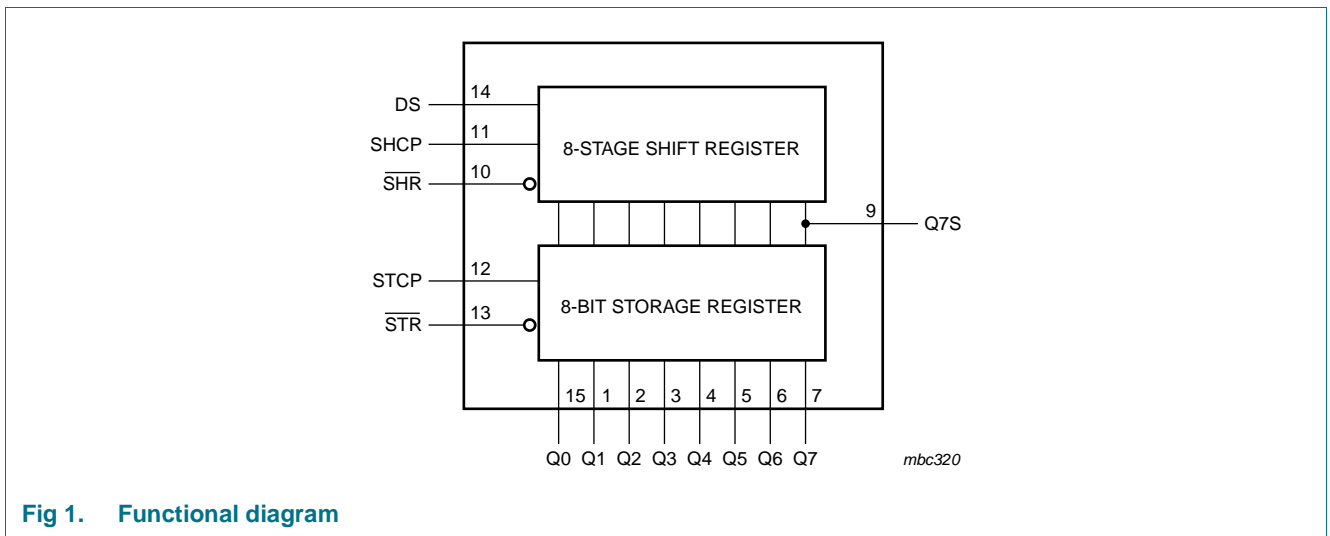


Fig 1. Functional diagram

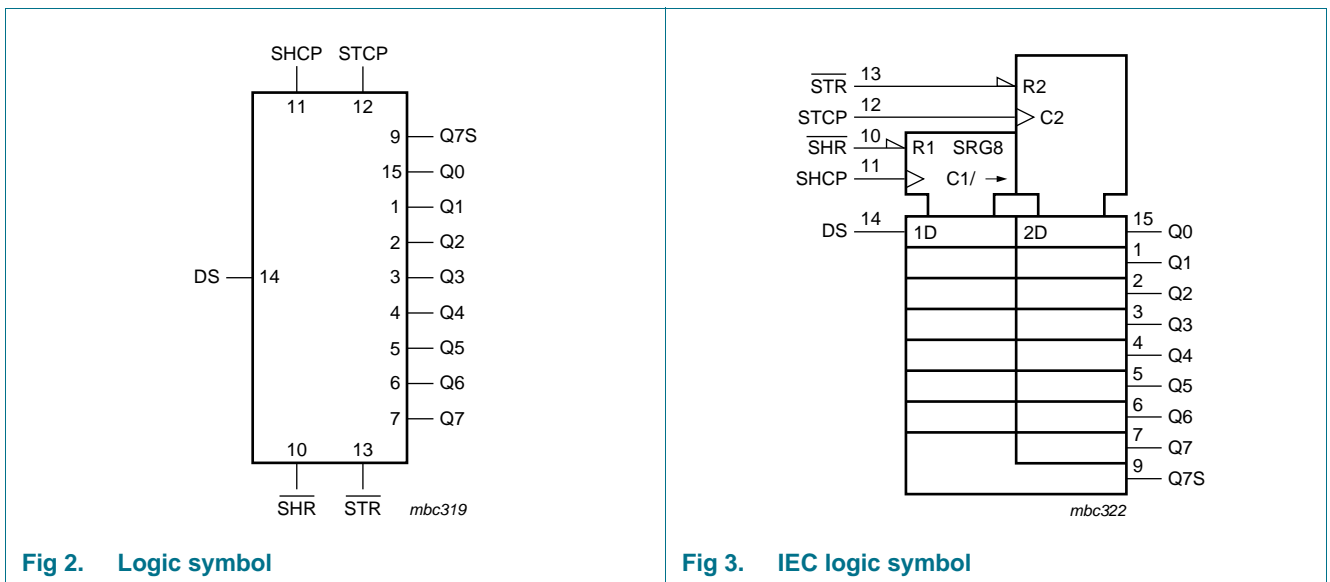


Fig 2. Logic symbol

Fig 3. IEC logic symbol

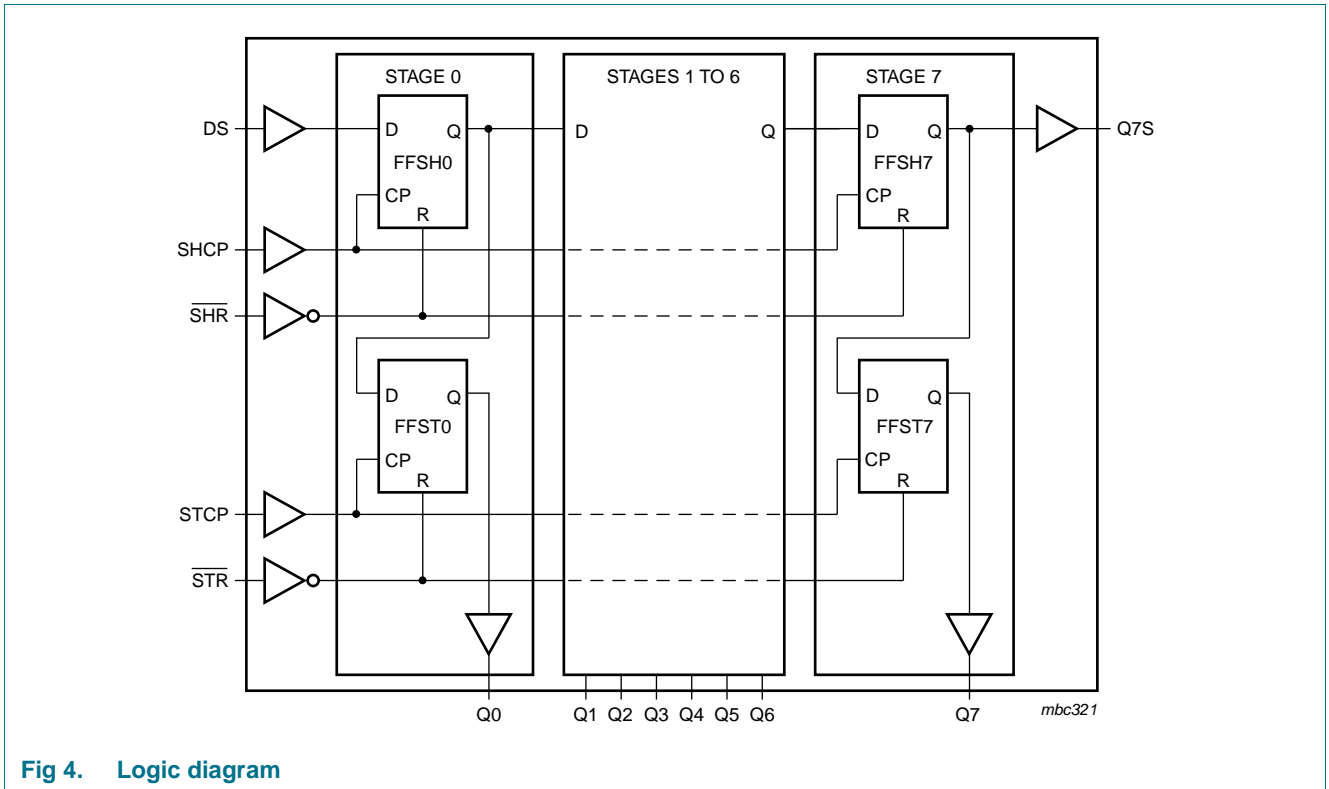


Fig 4. Logic diagram

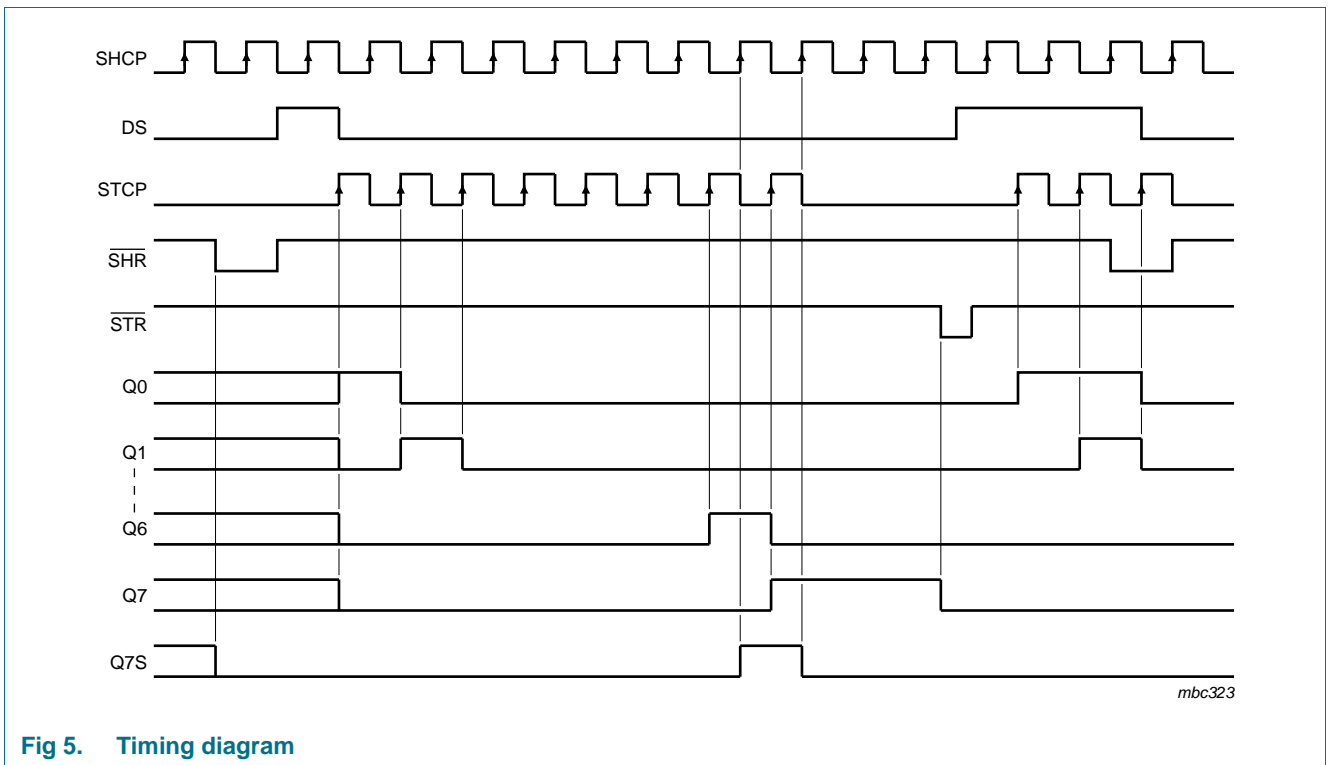
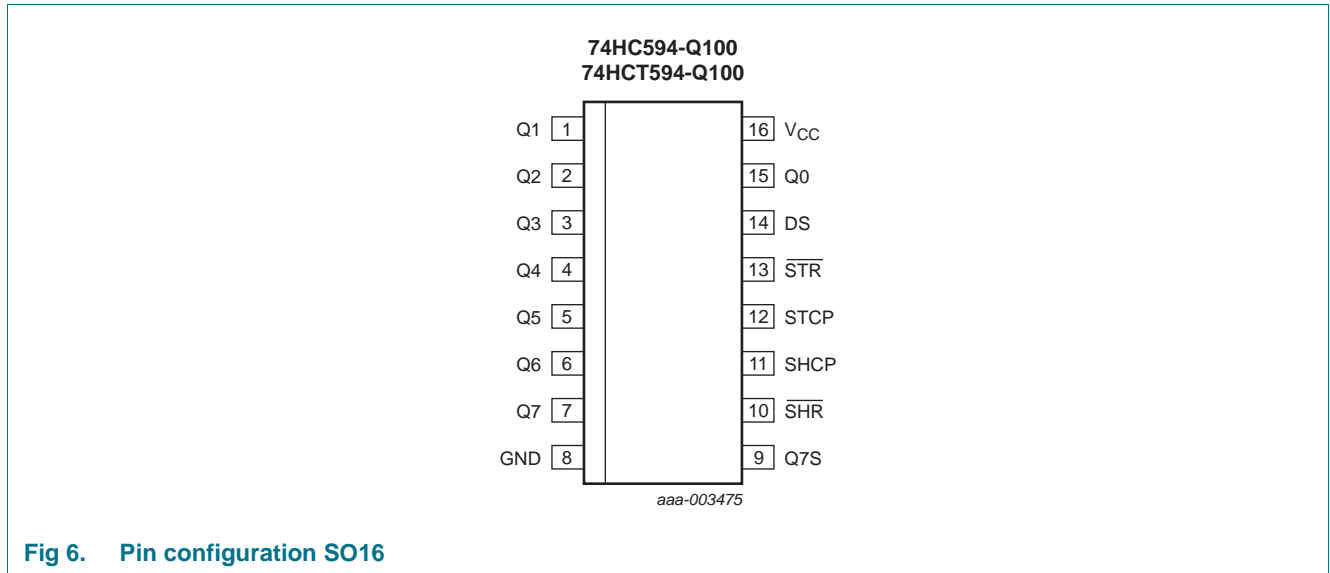


Fig 5. Timing diagram

## 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
$\overline{\text{SHR}}$	10	shift register reset (active LOW)
SHCP	11	shift register clock input
STCP	12	storage register clock input
$\overline{\text{STR}}$	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
$V_{CC}$	supply voltage		-0.5	+7.0	V
$I_{IK}$	input clamping current	$V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$	[1] -	±20	mA
$I_{OK}$	output clamping current	$V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$	[1] -	±20	mA
$I_O$	output current	$V_O = -0.5\text{ V}$ to $V_{CC} + 0.5\text{ V}$			
		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	$T_{amb} = -40\text{ °C}$ to $+125\text{ °C}$	[2] -	500	mW

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] For SO16 packages: above 70 °C the value of  $P_{tot}$  derates linearly with 8 mW/K.

## 9. Recommended operating conditions

**Table 5. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Type 74HC594-Q100</b>						
$V_{CC}$	supply voltage		2.0	5.0	6.0	V
$V_I$	input voltage		0	-	$V_{CC}$	V
$V_O$	output voltage		0	-	$V_{CC}$	V
$T_{amb}$	ambient temperature		-40	+25	+125	°C
$t_r$	rise time	$V_{CC} = 2.0\text{ V}$	-	-	1000	ns
		$V_{CC} = 4.5\text{ V}$	-	6.0	500	ns
		$V_{CC} = 6.0\text{ V}$	-	-	400	ns
$t_f$	fall time	$V_{CC} = 2.0\text{ V}$	-	-	1000	ns
		$V_{CC} = 4.5\text{ V}$	-	6.0	500	ns
		$V_{CC} = 6.0\text{ V}$	-	-	400	ns
<b>Type 74HCT594-Q100</b>						
$V_{CC}$	supply voltage		4.5	5.0	5.5	V
$V_I$	input voltage		0	-	$V_{CC}$	V
$V_O$	output voltage		0	-	$V_{CC}$	V
$T_{amb}$	ambient temperature		-40	+25	+125	°C
$t_r$	rise time	$V_{CC} = 4.5\text{ V}$	-	6.0	500	ns
$t_f$	fall time	$V_{CC} = 4.5\text{ V}$	-	6.0	500	ns

## 10. Static characteristics

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b><math>T_{amb} = 25\text{ °C}</math></b>						
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 2.0\text{ V}$	1.5	1.2	-	V
		$V_{CC} = 4.5\text{ V}$	3.15	2.4	-	V
		$V_{CC} = 6.0\text{ V}$	4.2	3.2	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 2.0\text{ V}$	-	0.8	0.5	V
		$V_{CC} = 4.5\text{ V}$	-	2.1	1.35	V
		$V_{CC} = 6.0\text{ V}$	-	2.8	1.8	V
$V_{OH}$	HIGH-level output voltage	$V_I = V_{IH}$ or $V_{IL}$				
<b>Serial data output Q7S</b>						
		$I_O = -4.0\text{ mA}; V_{CC} = 4.5\text{ V}$	3.98	4.32	-	V
		$I_O = -5.2\text{ mA}; V_{CC} = 6.0\text{ V}$	5.48	5.81	-	V
<b>Parallel data outputs</b>						
		$I_O = -6.0\text{ mA}; V_{CC} = 4.5\text{ V}$	3.98	4.32	-	V
		$I_O = -7.8\text{ mA}; V_{CC} = 6.0\text{ V}$	5.48	5.81	-	V

**Table 6.** Static characteristics type 74HC594-Q100 ...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	-	0.15	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>O</sub> = 7.8 mA; V <sub>CC</sub> = 6.0 V	-	0.16	0.26	V	
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V	-	-	±0.1	μA	
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 6.0 V	-	-	8.0	μA	
C <sub>i</sub>	input capacitance		-	3.5	-	pF	
<b>T<sub>amb</sub> = -40 °C to +85 °C</b>							
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 2.0 V	1.5	-	-	V	
		V <sub>CC</sub> = 4.5 V	3.15	-	-	V	
		V <sub>CC</sub> = 6.0 V	4.2	-	-	V	
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 2.0 V	-	-	0.5	V	
		V <sub>CC</sub> = 4.5 V	-	-	1.35	V	
		V <sub>CC</sub> = 6.0 V	-	-	1.8	V	
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>					
		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	
		I <sub>O</sub> = -7.8 mA; V <sub>CC</sub> = 6.0 V	5.34	-	-	V	
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>					
		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>O</sub> = 7.8 mA; V <sub>CC</sub> = 6.0 V	-	-	0.33	V	
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V	-	-	±1.0	μA	
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 6.0 V	-	-	80	μA	

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit			
$T_{amb} = -40\text{ }^{\circ}\text{C to }+125\text{ }^{\circ}\text{C}$									
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 2.0\text{ V}$	1.5	-	-	V			
		$V_{CC} = 4.5\text{ V}$	3.15	-	-	V			
		$V_{CC} = 6.0\text{ V}$	4.2	-	-	V			
$V_{IL}$	LOW-level input voltage	$V_{CC} = 2.0\text{ V}$	-	-	0.5	V			
		$V_{CC} = 4.5\text{ V}$	-	-	1.35	V			
		$V_{CC} = 6.0\text{ V}$	-	-	1.8	V			
$V_{OH}$	HIGH-level output voltage	$V_I = V_{IH}$ or $V_{IL}$							
		<b>Serial data output Q7S</b>							
		$I_O = -4.0\text{ mA}; V_{CC} = 4.5\text{ V}$	3.7	-	-	V			
		$I_O = -5.2\text{ mA}; V_{CC} = 6.0\text{ V}$	5.2	-	-	V			
		<b>Parallel data outputs</b>							
		$I_O = -6.0\text{ mA}; V_{CC} = 4.5\text{ V}$	3.7	-	-	V			
		$I_O = -7.8\text{ mA}; V_{CC} = 6.0\text{ V}$	5.2	-	-	V			
		$V_{OL}$	LOW-level output voltage	$V_I = V_{IH}$ or $V_{IL}$					
				<b>Serial data output Q7S</b>					
				$I_O = 4.0\text{ mA}; V_{CC} = 4.5\text{ V}$	-	-	0.4	V	
$I_O = 5.2\text{ mA}; V_{CC} = 6.0\text{ V}$	-			-	0.4	V			
<b>Parallel data outputs</b>									
$I_O = 6.0\text{ mA}; V_{CC} = 4.5\text{ V}$	-			-	0.4	V			
$I_I$	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 6.0\text{ V}$	-	-	$\pm 1.0$	$\mu\text{A}$			
		$V_I = V_{CC}$ or GND; $I_O = 0\text{ A}; V_{CC} = 6.0\text{ V}$	-	-	160	$\mu\text{A}$			

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>T<sub>amb</sub> = 25 °C</b>						
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	1.6	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	-	1.2	0.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		<b>Serial data output Q7S</b>				
		I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V	3.98	4.32	-	V
		<b>Parallel data outputs</b>				
		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>				
		<b>Serial data output Q7S</b>				
		I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.26	V
		<b>Parallel data outputs</b>				
		I <sub>O</sub> = 6.0 mA; V <sub>CC</sub> = 4.5 V	-	0.16	0.26	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	-	-	±0.1	μA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	8.0	μA
ΔI <sub>CC</sub>	additional supply current	per input pin; V <sub>I</sub> = V <sub>CC</sub> - 2.1 V and other inputs at V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 4.5 V to 5.5 V				
		pins $\overline{\text{SHR}}$ , SHCP, STCP, $\overline{\text{STR}}$	-	150	540	μA
		pin DS	-	25	90	μA
C <sub>i</sub>	input capacitance		-	3.5	-	pF
<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>				
		<b>Serial data output Q7S</b>				
		I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V	3.84	-	-	V
		<b>Parallel data outputs</b>				
		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>				
		<b>Serial data output</b>				
		I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V	-	-	0.33	V
		<b>Parallel data outputs</b>				
		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

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$\Delta I_{CC}$	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 $\overline{SHR}$ , SHCP, STCP, $\overline{STR}$	-	-	675	$\mu$ A	
		pin DS	-	-	112.5	$\mu$ A	
<b><math>T_{amb} = -40</math> °C to <math>+125</math> °C</b>							
$V_{IH}$	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 $V_{IL}$					
		<b>Serial data output Q7S</b>					
		$I_O = -4.0$ mA; $V_{CC} = 4.5$ V	3.7	-	-	V	
		<b>Parallel data outputs</b>					
		$I_O = -6.0$ mA; $V_{CC} = 4.5$ V	3.7	-	-	V	
$V_{OL}$	LOW-level output voltage	$V_I = V_{IH}$ or $V_{IL}$					
		<b>Serial data output Q7S</b>					
		$I_O = 4.0$ mA; $V_{CC} = 4.5$ V	-	-	0.4	V	
		<b>Parallel data outputs</b>					
		$I_O = 6.0$ 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	-	-	$\pm 1.0$	$\mu$ A	
$I_{CC}$	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	160	$\mu$ A	
$\Delta I_{CC}$	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 $\overline{SHR}$ , SHCP, STCP, $\overline{STR}$	-	-	735	$\mu$ A	
		pin DS	-	-	122.5	$\mu$ A	

## 11. Dynamic characteristics

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

$GND = 0\text{ V}$ ;  $t_r = t_f = 6\text{ ns}$ ;  $C_L = 50\text{ pF}$ ; see [Figure 13](#).

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
$t_{pd}$	propagation delay	SHCP to Q7S; see <a href="#">Figure 7</a> <sup>[1]</sup>								
		$V_{CC} = 2.0\text{ V}$	-	44	150	-	185	-	225	ns
		$V_{CC} = 4.5\text{ V}$	-	16	30	-	37	-	45	ns
		$V_{CC} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$	-	13	-	-	-	-	-	ns
		$V_{CC} = 6.0\text{ V}$	-	14	26	-	31	-	38	ns
		STCP to Qn; see <a href="#">Figure 8</a>								
		$V_{CC} = 2.0\text{ V}$	-	44	150	-	185	-	225	ns
		$V_{CC} = 4.5\text{ V}$	-	16	30	-	37	-	45	ns
		$V_{CC} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$	-	13	-	-	-	-	-	ns
		$V_{CC} = 6.0\text{ V}$	-	14	26	-	31	-	38	ns
$t_{PHL}$	HIGH to LOW propagation delay	SHR to Q7S; see <a href="#">Figure 11</a>								
		$V_{CC} = 2.0\text{ V}$	-	39	150	-	185	-	225	ns
		$V_{CC} = 4.5\text{ V}$	-	14	30	-	37	-	45	ns
		$V_{CC} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$	-	11	-	-	-	-	-	ns
		$V_{CC} = 6.0\text{ V}$	-	12	26	-	31	-	38	ns
		STR to Qn; see <a href="#">Figure 12</a>								
		$V_{CC} = 2.0\text{ V}$	-	39	125	-	155	-	185	ns
		$V_{CC} = 4.5\text{ V}$	-	14	25	-	31	-	37	ns
		$V_{CC} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$	-	11	-	-	-	-	-	ns
		$V_{CC} = 6.0\text{ V}$	-	12	21	-	26	-	31	ns
$t_{THL}$	HIGH to LOW output transition time	see <a href="#">Figure 7</a>								
		<b>Serial data output Q7S</b>								
		$V_{CC} = 2.0\text{ V}$	-	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
		<b>Parallel data outputs</b>								
		$V_{CC} = 2.0\text{ V}$	-	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-Q100 ...continued**

$GND = 0\text{ V}$ ;  $t_r = t_f = 6\text{ ns}$ ;  $C_L = 50\text{ pF}$ ; see [Figure 13](#).

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
$t_{TLH}$	LOW to HIGH output transition time	see <a href="#">Figure 7</a>								
		<b>Serial data output Q7S</b>								
		$V_{CC} = 2.0\text{ V}$	-	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
		<b>Parallel data outputs</b>								
		$V_{CC} = 2.0\text{ V}$	-	14	60	-	75	-	90	ns
		$V_{CC} = 4.5\text{ V}$	-	5	12	-	15	-	18	ns
		$V_{CC} = 6.0\text{ V}$	-	4	10	-	13	-	15	ns
		$t_W$	pulse width	SHCP (HIGH or LOW); see <a href="#">Figure 7</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 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
SHR and STR (HIGH or LOW); see <a href="#">Figure 11</a> and <a href="#">Figure 12</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

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

$GND = 0\text{ V}$ ;  $t_r = t_f = 6\text{ ns}$ ;  $C_L = 50\text{ pF}$ ; see [Figure 13](#).

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit	
			Min	Typ	Max	Min	Max	Min	Max		
$t_{su}$	set-up time	DS to SHCP; see <a href="#">Figure 9</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 10</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 8</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 9</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 11</a> and <a href="#">Figure 12</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	
$f_{max}$	maximum frequency	SHCP or STCP; see <a href="#">Figure 7</a> and <a href="#">Figure 8</a>									
		$V_{CC} = 2.0\text{ V}$	6.0	30	-	4.8	-	4.0	-	MHz	
		$V_{CC} = 4.5\text{ V}$	30	92	-	24	-	20	-	MHz	
		$V_{CC} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$	-	100	-	-	-	-	-	MHz	
		$V_{CC} = 6.0\text{ V}$	35	109	-	28	-	24	-	MHz	

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

$GND = 0\text{ V}$ ;  $t_r = t_f = 6\text{ ns}$ ;  $C_L = 50\text{ pF}$ ; see [Figure 13](#).

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
$C_{PD}$	power dissipation capacitance	$V_I = GND$ to $V_{CC}$ ; <a href="#">[2]</a> $V_{CC} = 5\text{ V}$ ; $f_i = 1\text{ MHz}$	-	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  $\mu\text{W}$ ):

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

$f_i$  = 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 74HCT594-Q100**

$GND = 0\text{ V}$ ;  $V_{CC} = 4.5\text{ V}$ ;  $t_r = t_f = 6\text{ ns}$ ;  $C_L = 50\text{ pF}$ ; see [Figure 13](#).

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; <a href="#">[1]</a> see <a href="#">Figure 7</a>	-	18	32	-	40	-	48	ns
		$V_{CC} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$	-	15	-	-	-	-	-	ns
		STCP to Qn; see <a href="#">Figure 8</a>	-	18	32	-	40	-	48	ns
		$V_{CC} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$	-	15	-	-	-	-	-	ns
$t_{PHL}$	HIGH to LOW propagation delay	SHR to Q7S; see <a href="#">Figure 11</a>	-	17	30	-	38	-	45	ns
		$V_{CC} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$	-	14	-	-	-	-	-	ns
		STR to Qn; see <a href="#">Figure 12</a>	-	17	30	-	38	-	45	ns
		$V_{CC} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$	-	14	-	-	-	-	-	ns
$t_{THL}$	HIGH to LOW output transition time	see <a href="#">Figure 7</a> <b>Serial data output Q7S</b>								
		$V_{CC} = 4.5\text{ V}$	-	7	15	-	19	-	22	ns
		<b>Parallel data outputs</b>								
		$V_{CC} = 4.5\text{ V}$	-	5	12	-	15	-	18	ns
$t_{TLH}$	LOW to HIGH output transition time	see <a href="#">Figure 7</a> <b>Serial data output Q7S</b>								
		$V_{CC} = 4.5\text{ V}$	-	7	15	-	19	-	22	ns
		<b>Parallel data outputs</b>								
		$V_{CC} = 4.5\text{ V}$	-	5	12	-	15	-	18	ns

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

$GND = 0\text{ V}$ ;  $V_{CC} = 4.5\text{ V}$ ;  $t_r = t_f = 6\text{ ns}$ ;  $C_L = 50\text{ pF}$ ; see [Figure 13](#).

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 7</a>	16	4	-	20	-	24	-	ns
		STCP (HIGH or LOW); see <a href="#">Figure 8</a>	16	4	-	20	-	24	-	ns
		$\overline{\text{SHR}}$ and $\overline{\text{STR}}$ (HIGH or LOW); see <a href="#">Figure 11</a> and <a href="#">Figure 12</a>	16	6	-	20	-	24	-	ns
$t_{su}$	set-up time	DS to SHCP; see <a href="#">Figure 9</a>	20	4	-	25	-	30	-	ns
		$\overline{\text{SHR}}$ to STCP; see <a href="#">Figure 10</a>	20	6	-	25	-	30	-	ns
		SHCP to STCP; see <a href="#">Figure 8</a>	20	7	-	25	-	30	-	ns
$t_h$	hold time	DS to SHCP; see <a href="#">Figure 9</a>	5	-3	-	6	-	7	-	ns
$t_{rec}$	recovery time	$\overline{\text{SHR}}$ to SHCP and $\overline{\text{STR}}$ to STCP; see <a href="#">Figure 11</a> and <a href="#">Figure 12</a>	10	-5	-	13	-	15	-	ns
$f_{max}$	maximum frequency	SHCP or STCP; see <a href="#">Figure 7</a> and <a href="#">Figure 8</a>	30	92	-	24	-	20	-	MHz
		$V_{CC} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$	-	100	-	-	-	-	-	MHz
$C_{PD}$	power dissipation capacitance	$V_I = GND$ to $V_{CC}$ <a href="#">[2]</a> - 1.5 V; $V_{CC} = 5\text{ V}$ ; $f_i = 1\text{ MHz}$	-	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  $\mu\text{W}$ ):

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

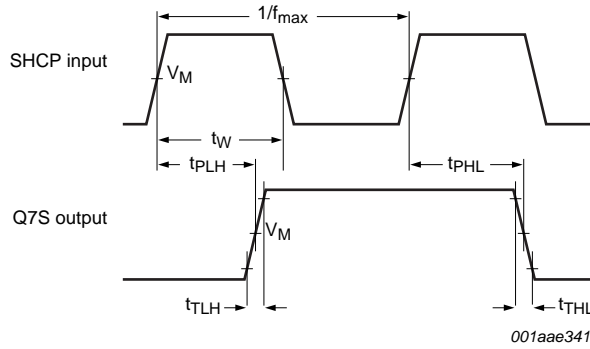
$C_L$  = output load capacitance in pF;

$V_{CC}$  = supply voltage in V;

$N$  = number of inputs switching;

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

12. Waveforms

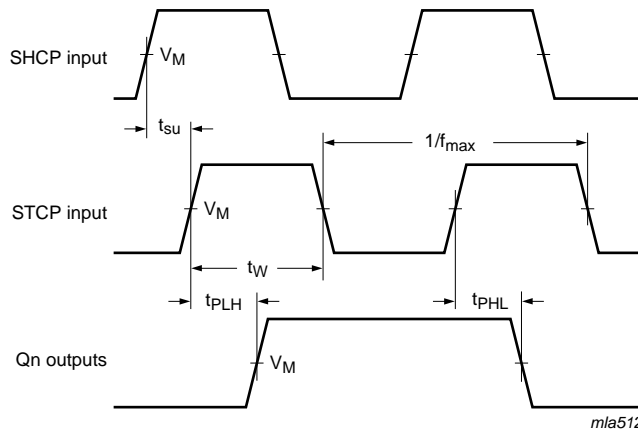


Measurement points are given in [Table 10](#).

$t_{PLH}$  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.

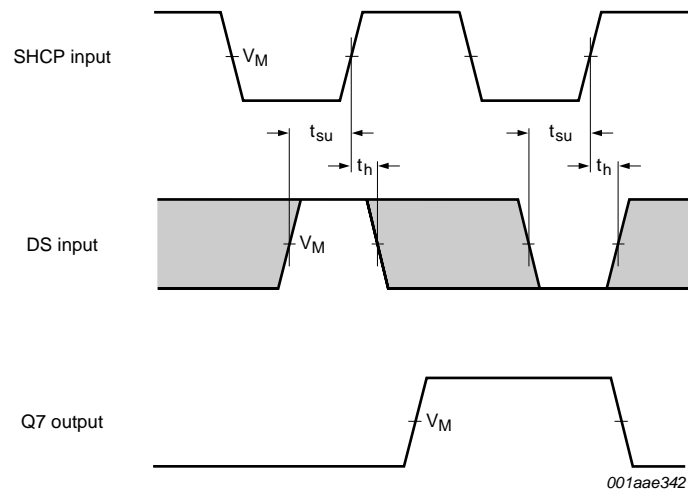
**Fig 7. The shift clock (SHCP) to output (Q7S) propagation delays, the shift clock pulse width, the maximum shift clock frequency, and output transition times**



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

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

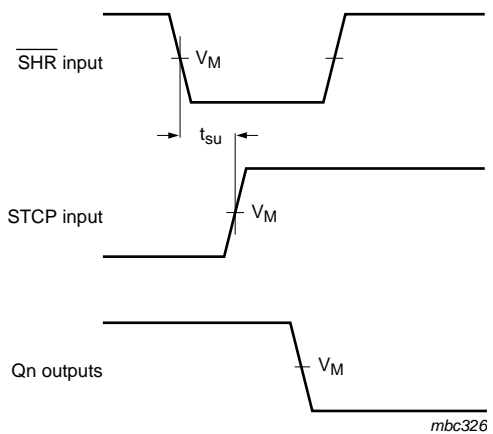
**Fig 8. The storage clock (STCP) to output (Qn), propagation delays, the storage clock pulse width, the maximum storage clock pulse frequency and the shift clock to storage clock set-up time**



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

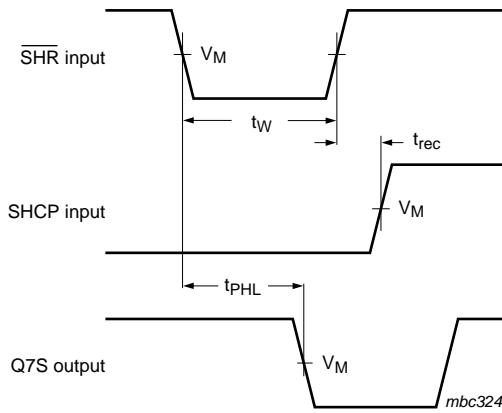
The shaded areas indicate when the input is permitted to change for predictable output performance.

**Fig 9. The data set-up time and hold times for DS input to SHCP**



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

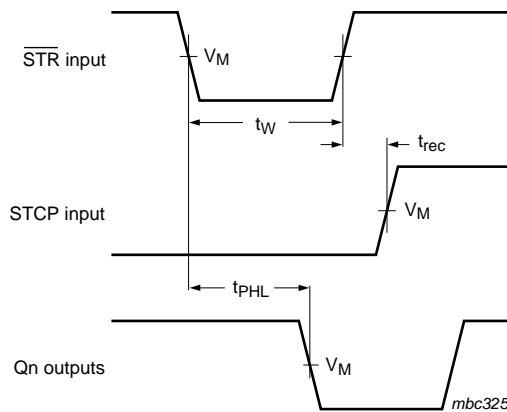
**Fig 10. The set-up time shift reset (SHR) to storage clock (STCP)**



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

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

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



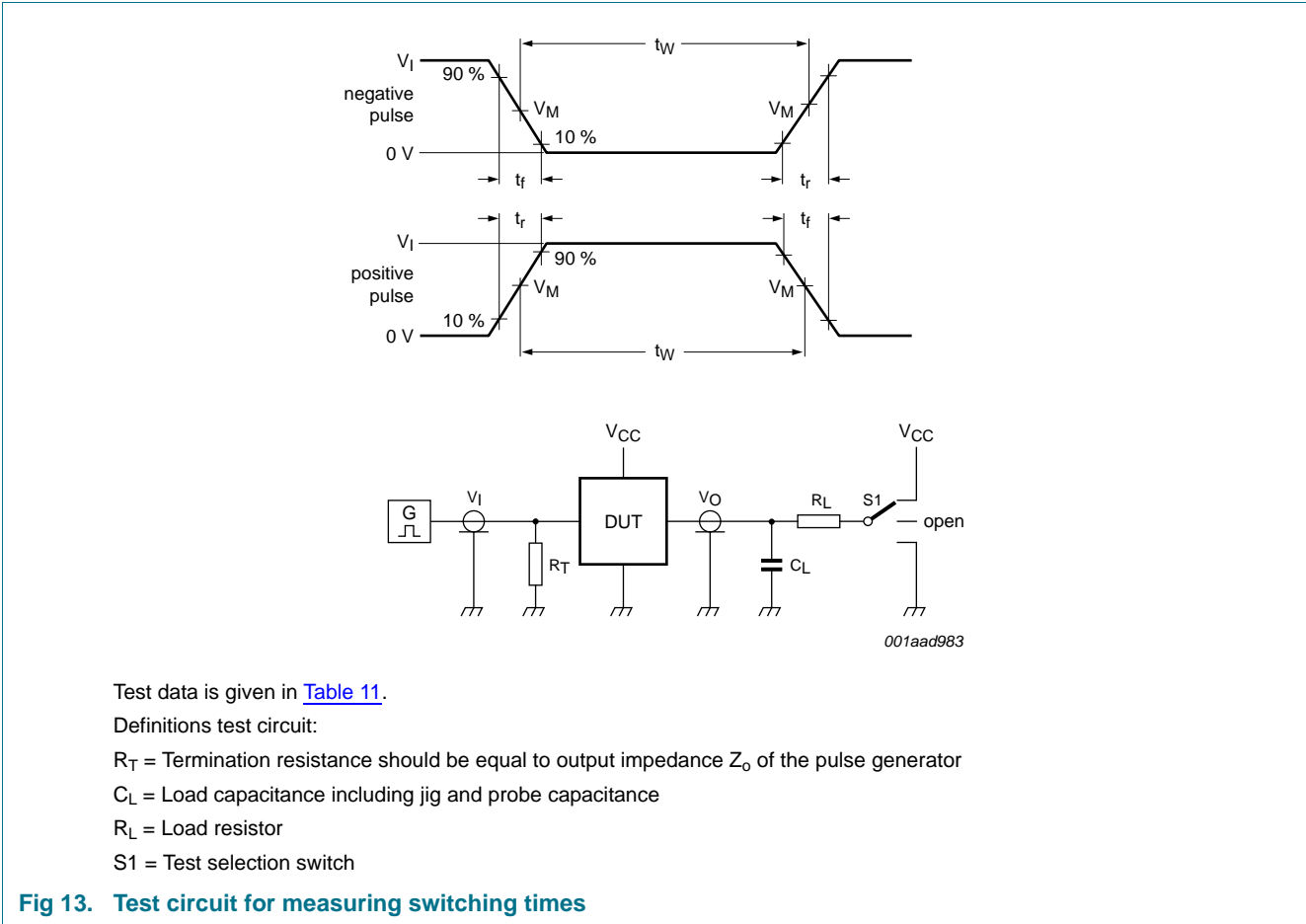
Measurement points are given in [Table 10](#).

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

**Fig 12. 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-Q100	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
74HCT594-Q100	1.3 V	1.3 V



**Table 11. Test data**

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

## 13. Package outline

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

SOT109-1

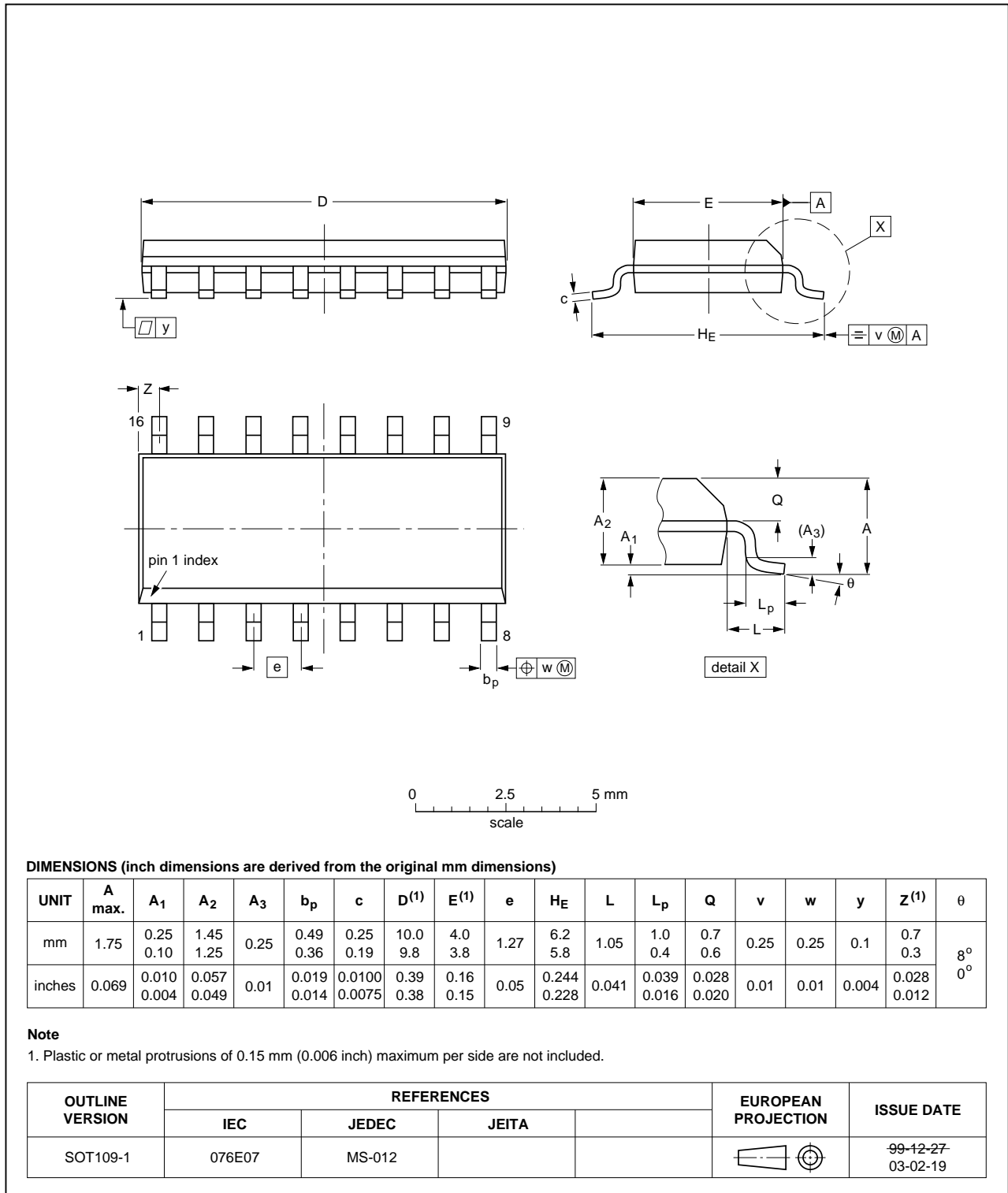


Fig 14. Package outline SOT109-1 (SO16)

## 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_Q100 v.1	20120802	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".

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