

# 74HC594; 74HCT594

## 8-bit shift register with output register

Rev. 6 — 22 October 2021

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 (SHR and 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
- 8-bit parallel output
- Shift and storage registers have independent direct clear and clocks
- Independent clocks for shift and storage registers
- 100 MHz (typical)
- Wide supply voltage range from 2.0 V to 6.0 V
- CMOS low power dissipation
- High noise immunity
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Input levels:
  - For 74HC594: CMOS level
  - For 74HCT594: TTL level
- Complies with JEDEC standards
  - JESD8C (2.7 V to 3.6 V)
  - JESD7A (2.0 V to 6.0 V)
- ESD protection:
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V (C = 200 pF, R = 0  $\Omega$ )
- Multiple package options
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

### 3. Applications

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

### 4. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74HC594D	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74HCT594D				
74HC594DB	-40 °C to +125 °C	SSOP16	plastic shrink small outline package; 16 leads; body width 5.3 mm	SOT338-1
74HCT594DB				
74HC594PW	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
74HCT594PW				

### 5. Functional diagram

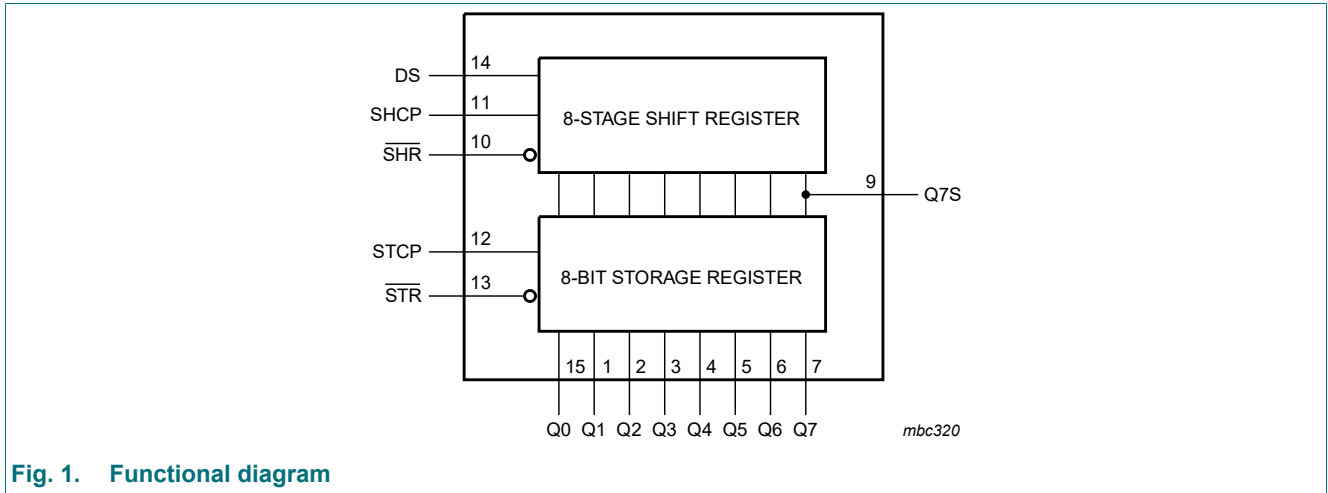


Fig. 1. Functional diagram

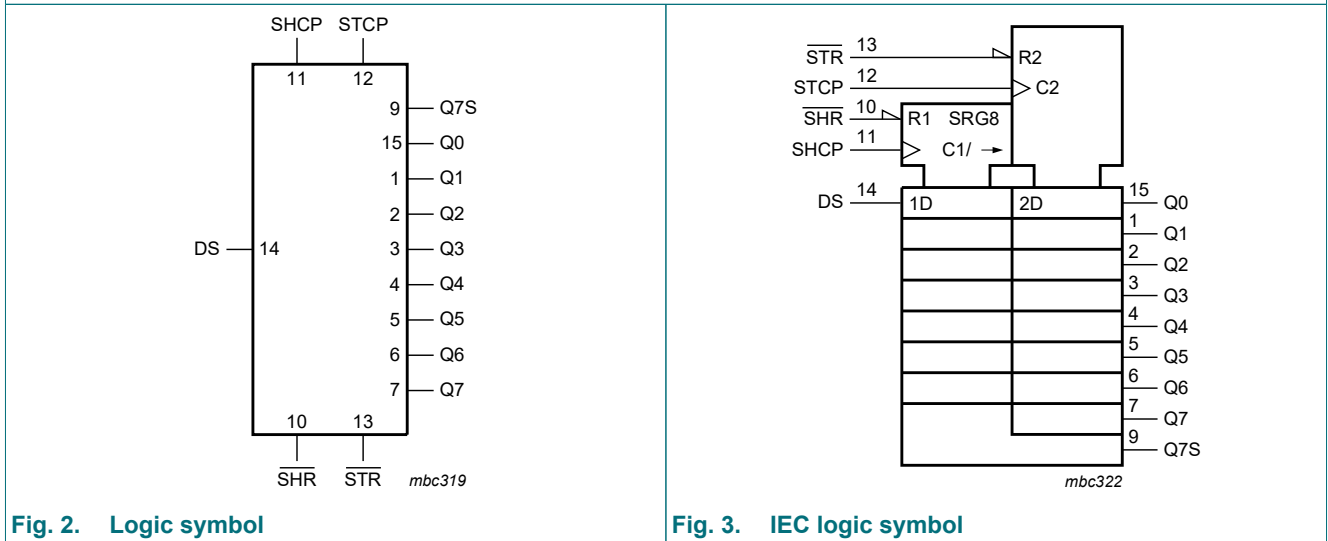


Fig. 2. Logic symbol

Fig. 3. IEC logic symbol

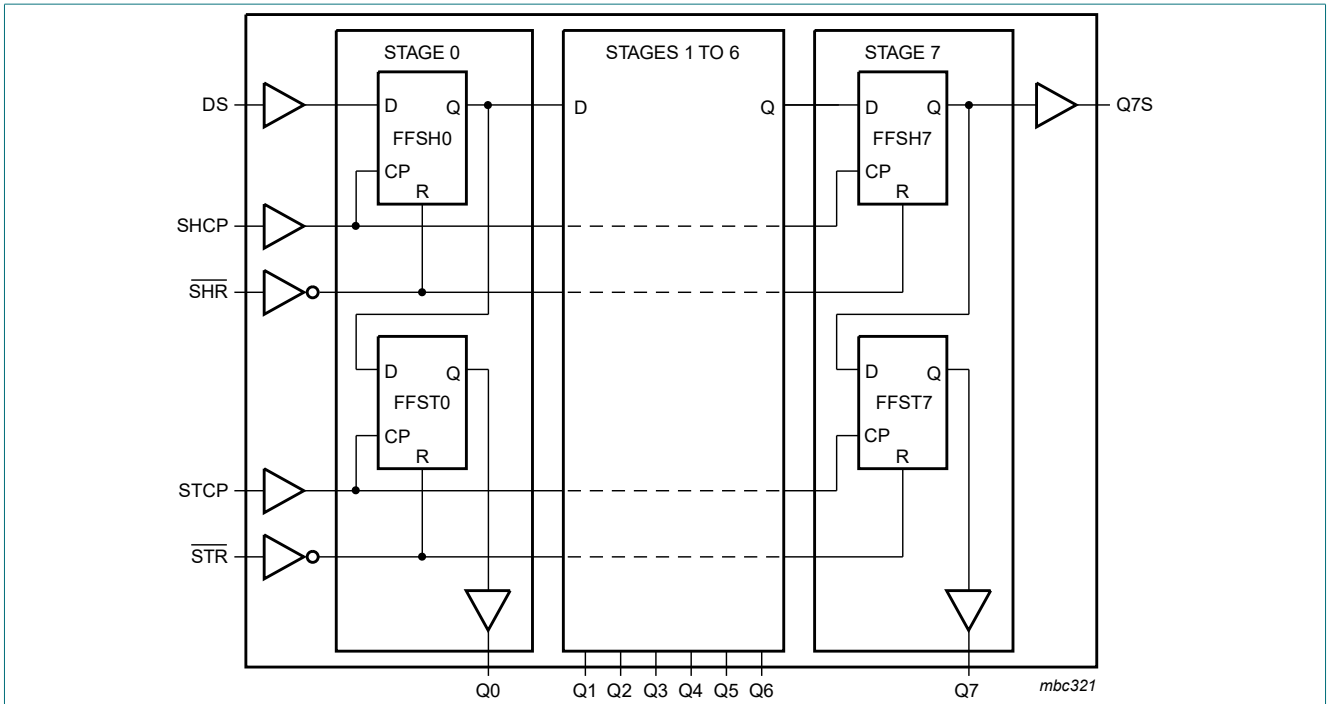


Fig. 4. Logic diagram

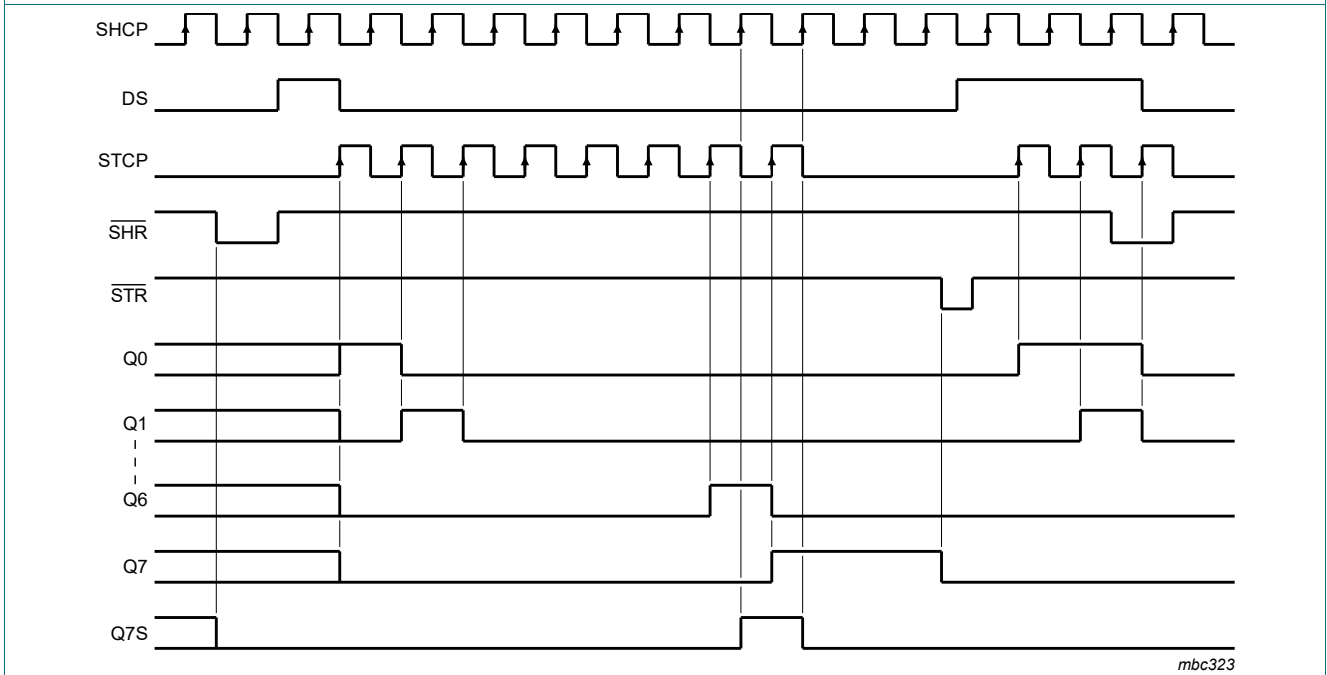


Fig. 5. Timing diagram

## 6. Pinning information

### 6.1. Pinning

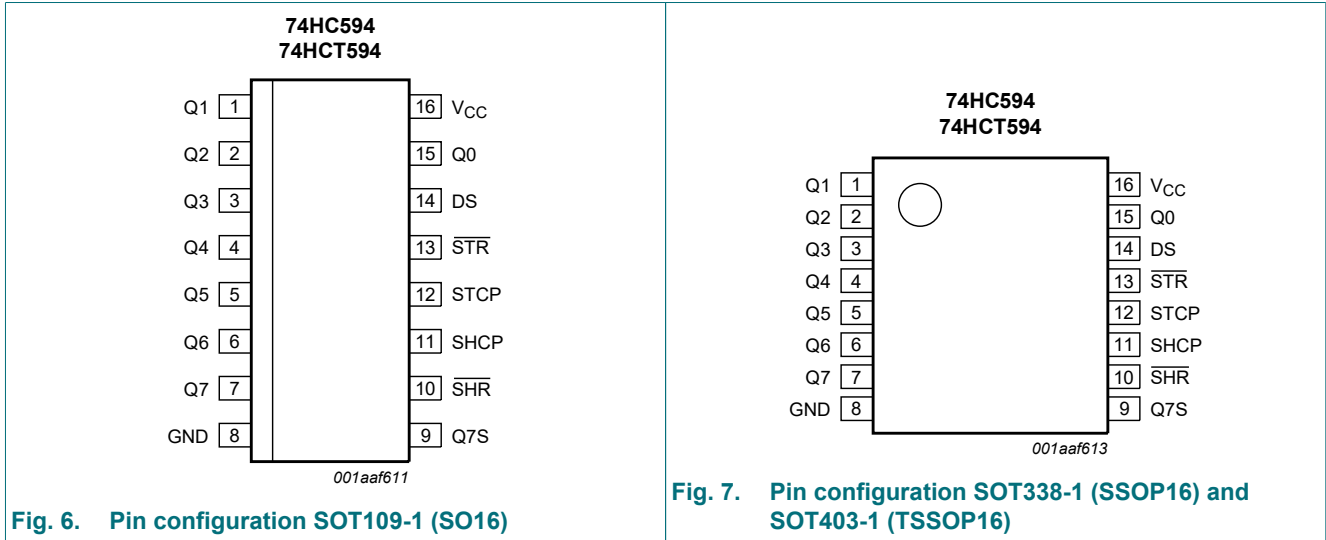


Fig. 6. Pin configuration SOT109-1 (SO16)

Fig. 7. Pin configuration SOT338-1 (SSOP16) and SOT403-1 (TSSOP16)

### 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

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

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

## 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]	-	$\pm 20$	mA
$I_{OK}$	output clamping current	$V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ [1]	-	$\pm 20$	mA
$I_O$	output current	$V_O = -0.5\text{ V}$ to $V_{CC} + 0.5\text{ V}$			
		Serial data output Q7S	-	$\pm 25$	mA
		Parallel data output Qn	-	$\pm 35$	mA
$I_{CC}$	supply current	Serial data output Q7S	-	50	mA
		Parallel data output Qn	-	70	mA
$I_{GND}$	ground current	Serial data output Q7S	-	-50	mA
		Parallel data output Qn	-	-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 SOT109-1 (SO16) package:  $P_{tot}$  derates linearly with 12.4 mW/K above 110 °C.

For SOT338-1 (SSOP16) package:  $P_{tot}$  derates linearly with 8.5 mW/K above 91 °C.

For SOT403-1 (TSSOP16) package:  $P_{tot}$  derates linearly with 8.5 mW/K above 91 °C.

## 9. Recommended operating conditions

**Table 5. Recommended operating conditions**

Voltages are referenced to GND (ground = 0 V)

Symbol	Parameter	Conditions	74HC594			74HCT594			Unit
			Min	Typ	Max	Min	Typ	Max	
$V_{CC}$	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
$V_I$	input voltage		0	-	$V_{CC}$	0	-	$V_{CC}$	V
$V_O$	output voltage		0	-	$V_{CC}$	0	-	$V_{CC}$	V
$T_{amb}$	ambient temperature		-40	-	+125	-40	-	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 2.0\text{ V}$	-	-	625	-	-	-	ns/V
		$V_{CC} = 4.5\text{ V}$	-	1.67	139	-	1.67	139	ns/V
		$V_{CC} = 6.0\text{ V}$	-	-	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>				
		Q7S; I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V	3.98	4.32	-	V
		Q7S; I <sub>O</sub> = -5.2 mA; V <sub>CC</sub> = 6.0 V	5.48	5.81	-	V
		Qn; I <sub>O</sub> = -6.0 mA; V <sub>CC</sub> = 4.5 V	3.98	4.32	-	V
		Qn; I <sub>O</sub> = -7.8 mA; V <sub>CC</sub> = 6.0 V	5.48	5.81	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		Q7S; I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.26	V
		Q7S; I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V	-	0.16	0.26	V
		Qn; I <sub>O</sub> = 6.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.26	V
		Qn; 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>				
		Q7S; I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V	3.84	-	-	V
		Q7S; I <sub>O</sub> = -5.2 mA; V <sub>CC</sub> = 6.0 V	5.34	-	-	V
		Qn; I <sub>O</sub> = -6.0 mA; V <sub>CC</sub> = 4.5 V	3.84	-	-	V
		Qn; 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>				
		Q7S; I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V	-	-	0.33	V
		Q7S; I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V	-	-	0.33	V
		Qn; I <sub>O</sub> = 6.0 mA; V <sub>CC</sub> = 4.5 V	-	-	0.33	V
		Qn; 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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<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>				
		Q7S; I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V	3.7	-	-	V
		Q7S; I <sub>O</sub> = -5.2 mA; V <sub>CC</sub> = 6.0 V	5.2	-	-	V
		Qn; I <sub>O</sub> = -6.0 mA; V <sub>CC</sub> = 4.5 V	3.7	-	-	V
		Qn; I <sub>O</sub> = -7.8 mA; V <sub>CC</sub> = 6.0 V	5.2	-	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		Q7S; I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V	-	-	0.4	V
		Q7S; I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V	-	-	0.4	V
		Qn; I <sub>O</sub> = 6.0 mA; V <sub>CC</sub> = 4.5 V	-	-	0.4	V
		Qn; I <sub>O</sub> = 7.8 mA; V <sub>CC</sub> = 6.0 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>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>				
		Q7S; I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V	3.98	4.32	-	V
		Qn; 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>				
		Q7S; I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.26	V
		Qn; 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 SHR, SHCP, STCP, STR	-	150	540	µA
		pin DS	-	25	90	µA
C <sub>i</sub>	input capacitance		-	3.5	-	pF

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>				
		Q7S; I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V	3.84	-	-	V
		Qn; 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>				
		Q7S; I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V	-	-	0.33	V
		Qn; 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, 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>				
		Q7S; I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V	3.7	-	-	V
		Qn; 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>				
		Q7S; I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V	-	-	0.4	V
		Qn; 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, STR	-	-	735	µA
		pin DS	-	-	122.5	µA



## 11. Dynamic characteristics

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

$GND = 0\text{ V}$ ;  $t_r = t_f = 6\text{ ns}$ ;  $C_L = 50\text{ pF}$ ; For test circuit see [Fig. 14](#).

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
$t_{pd}$	propagation delay	SHCP to Q7S; see <a href="#">Fig. 8</a> [1]								
		$V_{CC} = 2.0\text{ V}$	-	44	150	-	185	-	225	ns
		$V_{CC} = 4.5\text{ V}$	-	16	30	-	37	-	45	ns
		$V_{CC} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$	-	13	-	-	-	-	-	ns
		$V_{CC} = 6.0\text{ V}$	-	14	26	-	31	-	38	ns
		STCP to Qn; see <a href="#">Fig. 9</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="#">Fig. 12</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="#">Fig. 13</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	Q7S; see <a href="#">Fig. 8</a>								
		$V_{CC} = 2.0\text{ V}$	-	19	75	-	95	-	110	ns
		$V_{CC} = 4.5\text{ V}$	-	7	15	-	19	-	22	ns
		$V_{CC} = 6.0\text{ V}$	-	6	13	-	16	-	19	ns
		Qn								
		$V_{CC} = 2.0\text{ V}$	-	14	60	-	75	-	90	ns
		$V_{CC} = 4.5\text{ V}$	-	5	12	-	15	-	18	ns
		$V_{CC} = 6.0\text{ V}$	-	4	10	-	13	-	15	ns
$t_{TLH}$	LOW to HIGH output transition time	Q7S; see <a href="#">Fig. 8</a>								
		$V_{CC} = 2.0\text{ V}$	-	19	75	-	95	-	110	ns
		$V_{CC} = 4.5\text{ V}$	-	7	15	-	19	-	22	ns
		$V_{CC} = 6.0\text{ V}$	-	6	13	-	16	-	19	ns
		Qn								
		$V_{CC} = 2.0\text{ V}$	-	14	60	-	75	-	90	ns
		$V_{CC} = 4.5\text{ V}$	-	5	12	-	15	-	18	ns
		$V_{CC} = 6.0\text{ V}$	-	4	10	-	13	-	15	ns

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="#">Fig. 8</a>								
		V <sub>CC</sub> = 2.0 V	80	10	-	100	-	120	-	ns
		V <sub>CC</sub> = 4.5 V	16	4	-	20	-	24	-	ns
		V <sub>CC</sub> = 6.0 V	14	3	-	17	-	20	-	ns
		STCP (HIGH or LOW); see <a href="#">Fig. 9</a>								
		V <sub>CC</sub> = 2.0 V	80	10	-	100	-	120	-	ns
		V <sub>CC</sub> = 4.5 V	16	4	-	20	-	24	-	ns
		V <sub>CC</sub> = 6.0 V	14	3	-	17	-	20	-	ns
		SHR and STR (HIGH or LOW); see <a href="#">Fig. 12</a> and <a href="#">Fig. 13</a>								
		V <sub>CC</sub> = 2.0 V	80	14	-	100	-	120	-	ns
		V <sub>CC</sub> = 4.5 V	16	5	-	20	-	24	-	ns
		V <sub>CC</sub> = 6.0 V	14	4	-	17	-	20	-	ns
t <sub>su</sub>	set-up time	DS to SHCP; see <a href="#">Fig. 10</a>								
		V <sub>CC</sub> = 2.0 V	100	10	-	125	-	150	-	ns
		V <sub>CC</sub> = 4.5 V	20	4	-	25	-	30	-	ns
		V <sub>CC</sub> = 6.0 V	17	3	-	21	-	26	-	ns
		SHR to STCP; see <a href="#">Fig. 11</a>								
		V <sub>CC</sub> = 2.0 V	100	14	-	125	-	150	-	ns
		V <sub>CC</sub> = 4.5 V	20	5	-	25	-	30	-	ns
		V <sub>CC</sub> = 6.0 V	17	4	-	21	-	26	-	ns
		SHCP to STCP; see <a href="#">Fig. 9</a>								
		V <sub>CC</sub> = 2.0 V	100	17	-	125	-	150	-	ns
		V <sub>CC</sub> = 4.5 V	20	6	-	25	-	30	-	ns
		V <sub>CC</sub> = 6.0 V	17	5	-	21	-	26	-	ns
t <sub>h</sub>	hold time	DS to SHCP; see <a href="#">Fig. 10</a>								
		V <sub>CC</sub> = 2.0 V	25	-8	-	30	-	35	-	ns
		V <sub>CC</sub> = 4.5 V	5	-3	-	6	-	7	-	ns
		V <sub>CC</sub> = 6.0 V	4	-2	-	5	-	6	-	ns
t <sub>rec</sub>	recovery time	SHR to SHCP and STR to STCP; see <a href="#">Fig. 12</a> and <a href="#">Fig. 13</a>								
		V <sub>CC</sub> = 2.0 V	50	-14	-	65	-	75	-	ns
		V <sub>CC</sub> = 4.5 V	10	-5	-	13	-	15	-	ns
		V <sub>CC</sub> = 6.0 V	9	-4	-	11	-	13	-	ns

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 Fig. 8 and Fig. 9								
		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; [2] f <sub>i</sub> = 1 MHz	-	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):

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

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**

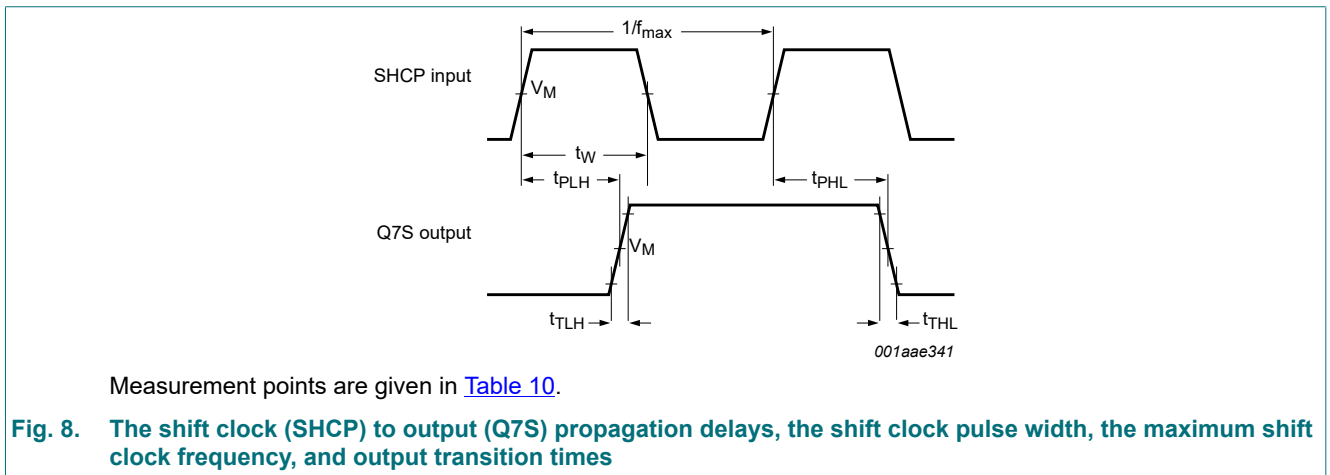
GND = 0 V; V<sub>CC</sub> = 4.5 V; t<sub>r</sub> = t<sub>f</sub> = 6 ns; C<sub>L</sub> = 50 pF; For test circuit see Fig. 14.

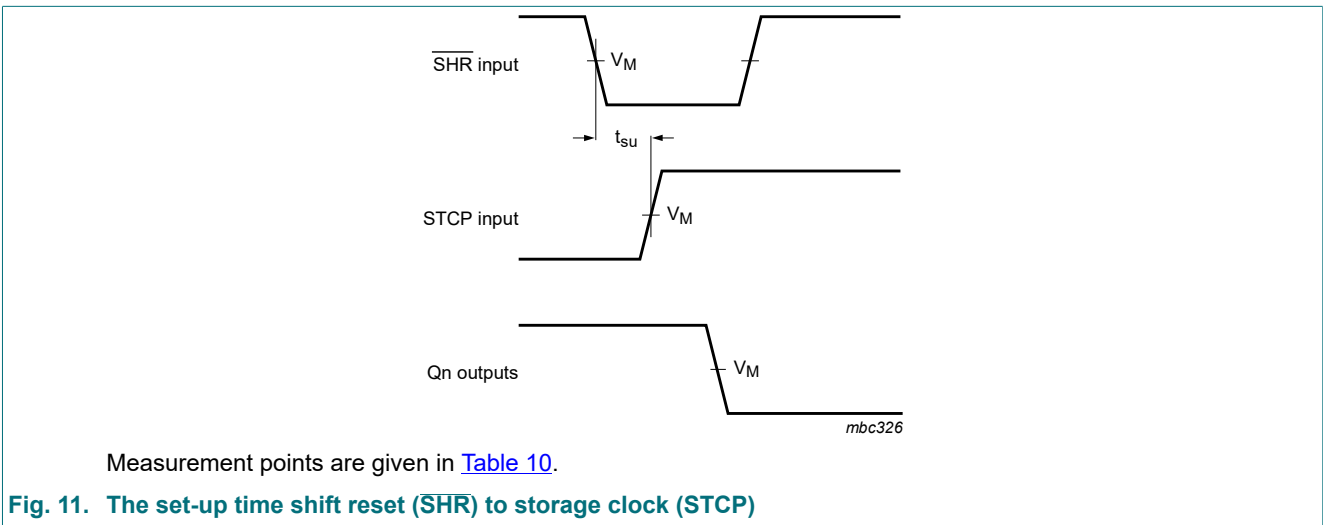
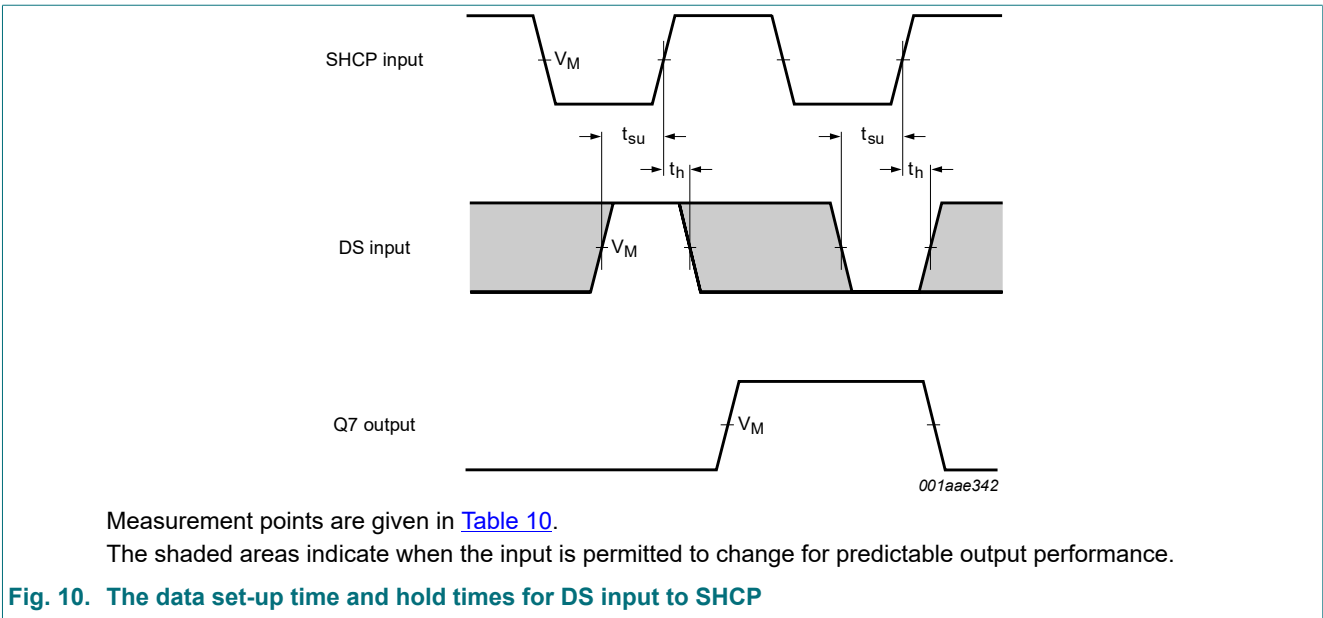
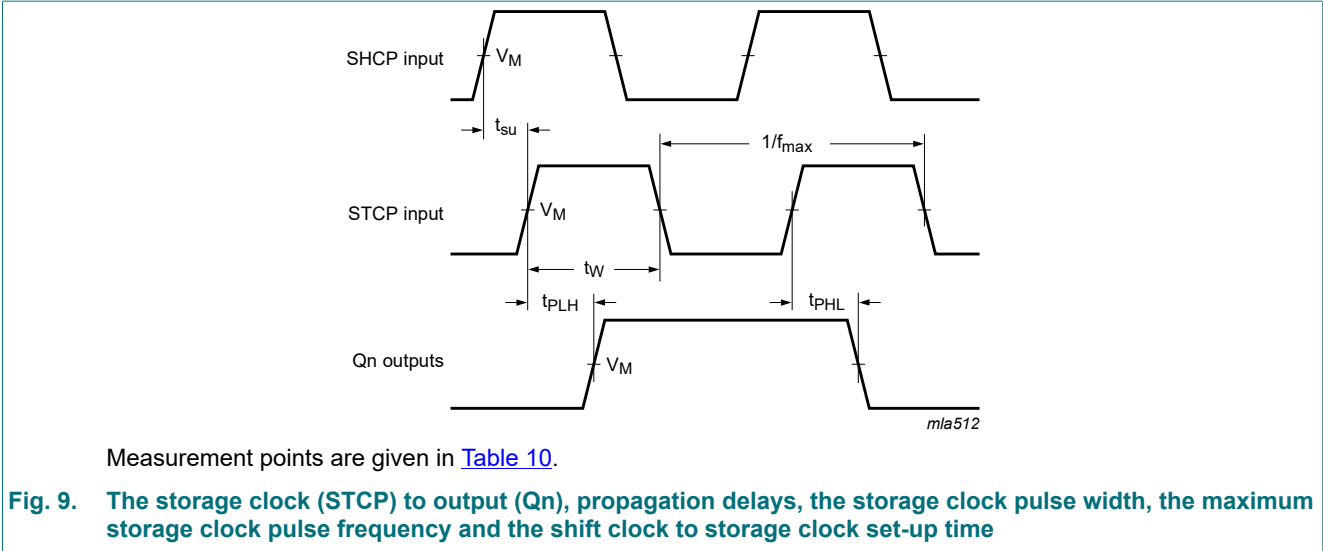
Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t <sub>pd</sub>	propagation delay	SHCP to Q7S; see Fig. 8 [1]	-	18	32	-	40	-	48	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	15	-	-	-	-	-	ns
		STCP to Qn; see Fig. 9	-	18	32	-	40	-	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 Fig. 12	-	17	30	-	38	-	45	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	14	-	-	-	-	-	ns
		STR to Qn; see Fig. 13	-	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 Fig. 8								
		V <sub>CC</sub> = 4.5 V	-	7	15	-	19	-	22	ns
		Qn								
t <sub>TLH</sub>	LOW to HIGH output transition time	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>w</sub>	pulse width	SHCP (HIGH or LOW); see Fig. 8	16	4	-	20	-	24	-	ns
		STCP (HIGH or LOW); see Fig. 9	16	4	-	20	-	24	-	ns
		SHR and STR (HIGH or LOW); see Fig. 12 and Fig. 13	16	6	-	20	-	24	-	ns

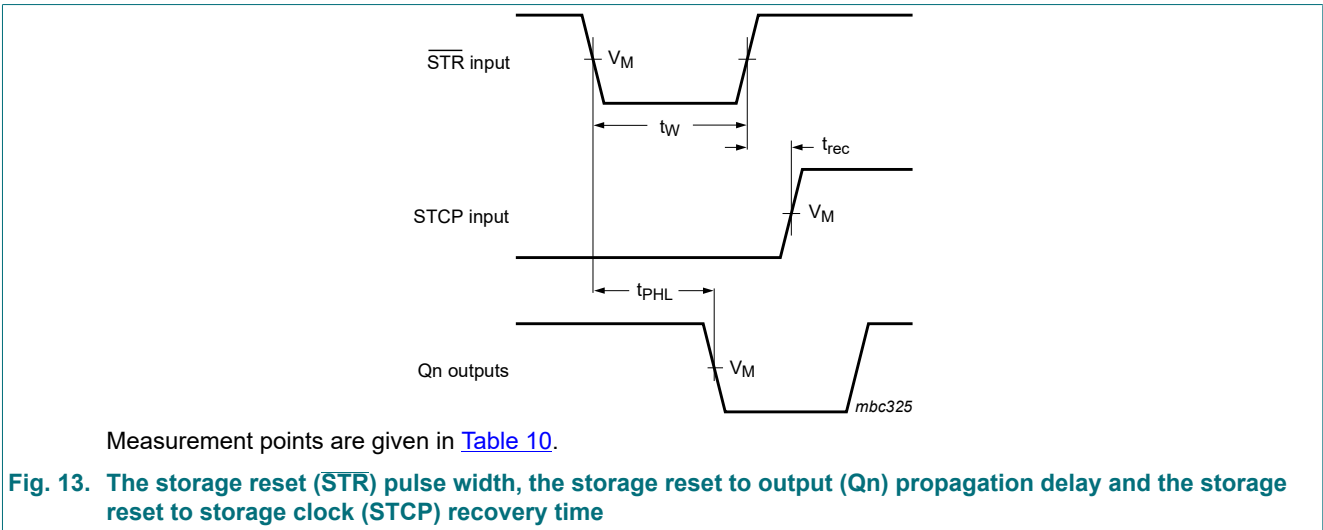
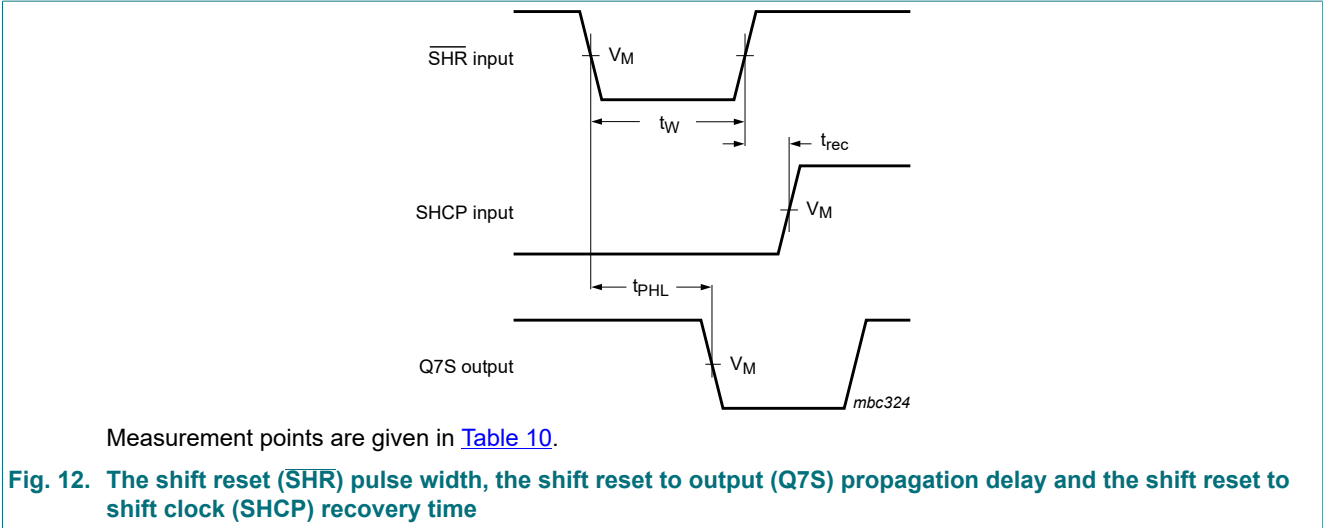
Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t <sub>su</sub>	set-up time	DS to SHCP; see Fig. 10	20	4	-	25	-	30	-	ns
		SHR to STCP; see Fig. 11	20	6	-	25	-	30	-	ns
		SHCP to STCP; see Fig. 9	20	7	-	25	-	30	-	ns
t <sub>h</sub>	hold time	DS to SHCP; see Fig. 10	5	-3	-	6	-	7	-	ns
t <sub>rec</sub>	recovery time	SHR to SHCP and STR to STCP; see Fig. 12 and Fig. 13	10	-5	-	13	-	15	-	ns
f <sub>max</sub>	maximum frequency	SHCP or STCP; see Fig. 8 and Fig. 9	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):  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o)$  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.

### 11.1. Waveforms and test circuit







**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

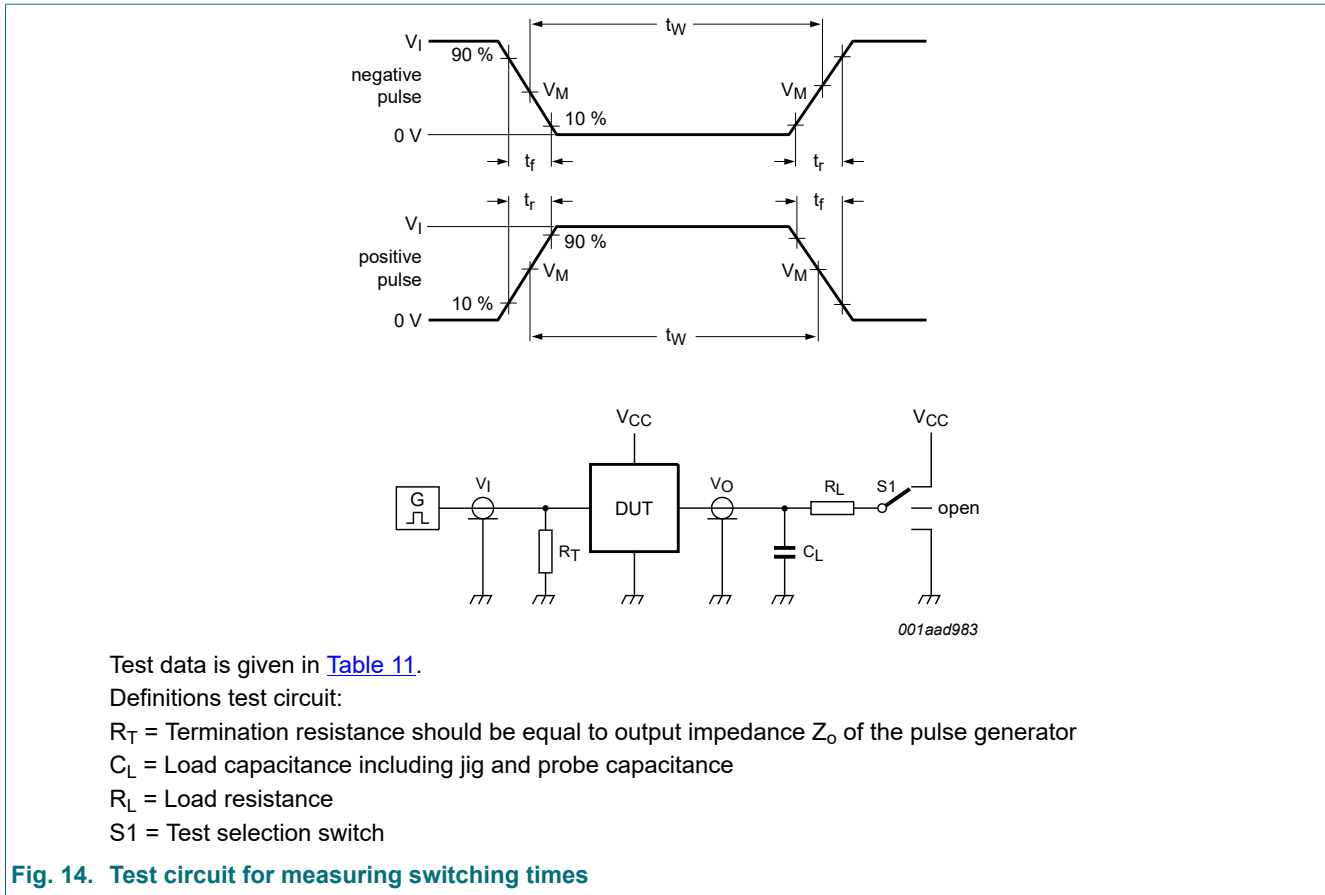


Table 11. Test data

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	$V_{CC}$

12. Package outline

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

SOT109-1

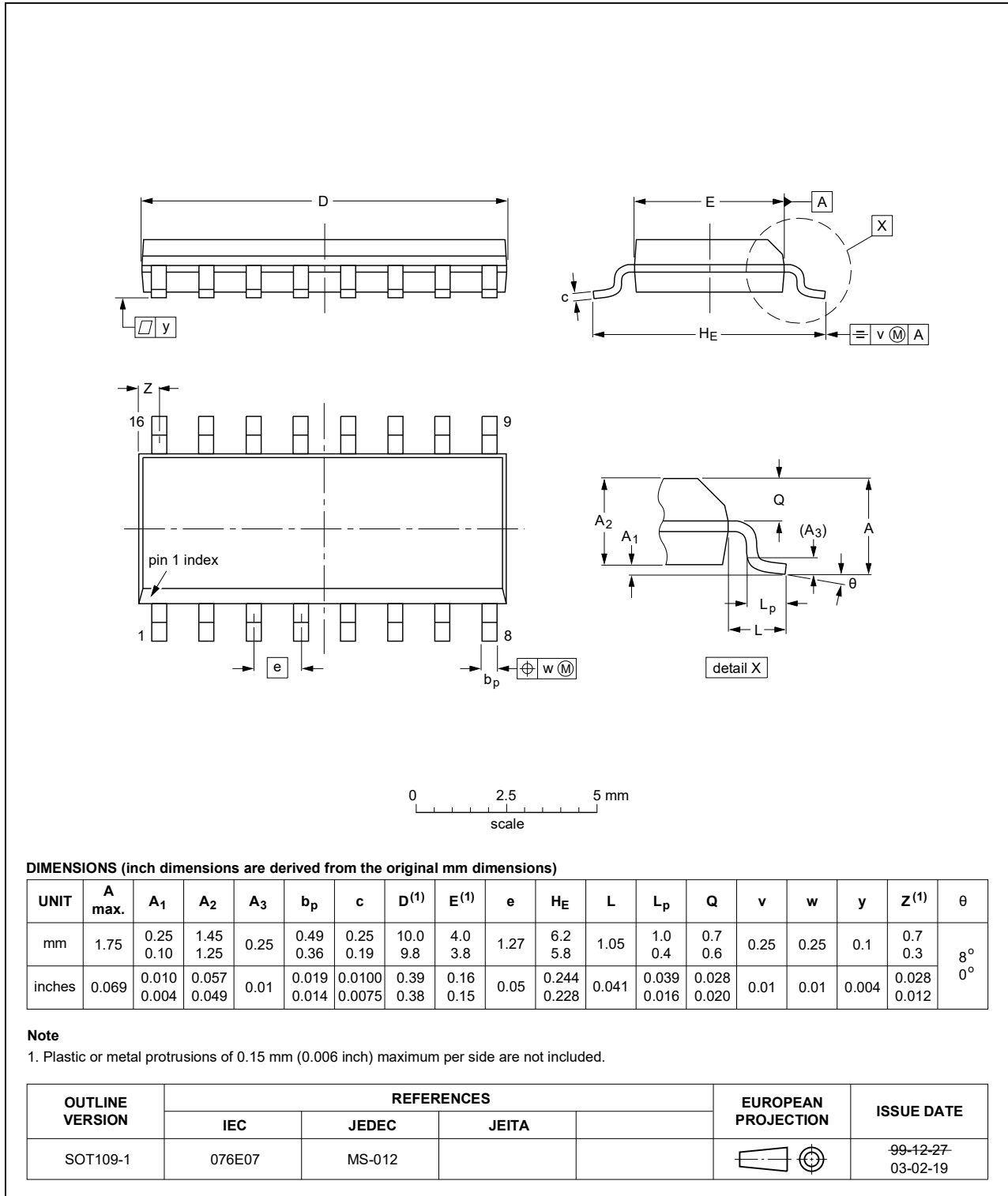


Fig. 15. Package outline SOT109-1 (SO16)



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

SOT338-1

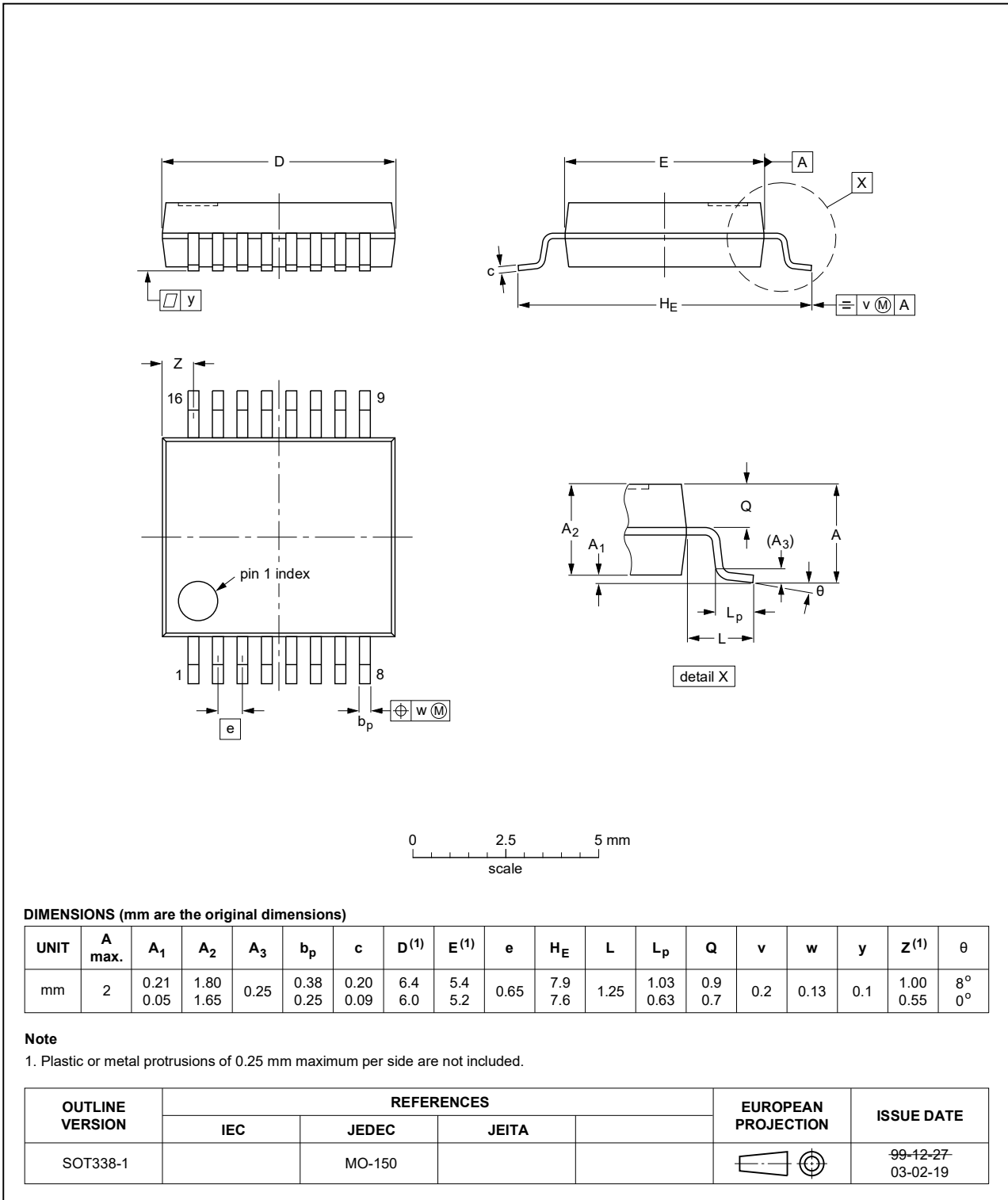


Fig. 16. Package outline SOT338-1 (SSOP16)

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

SOT403-1

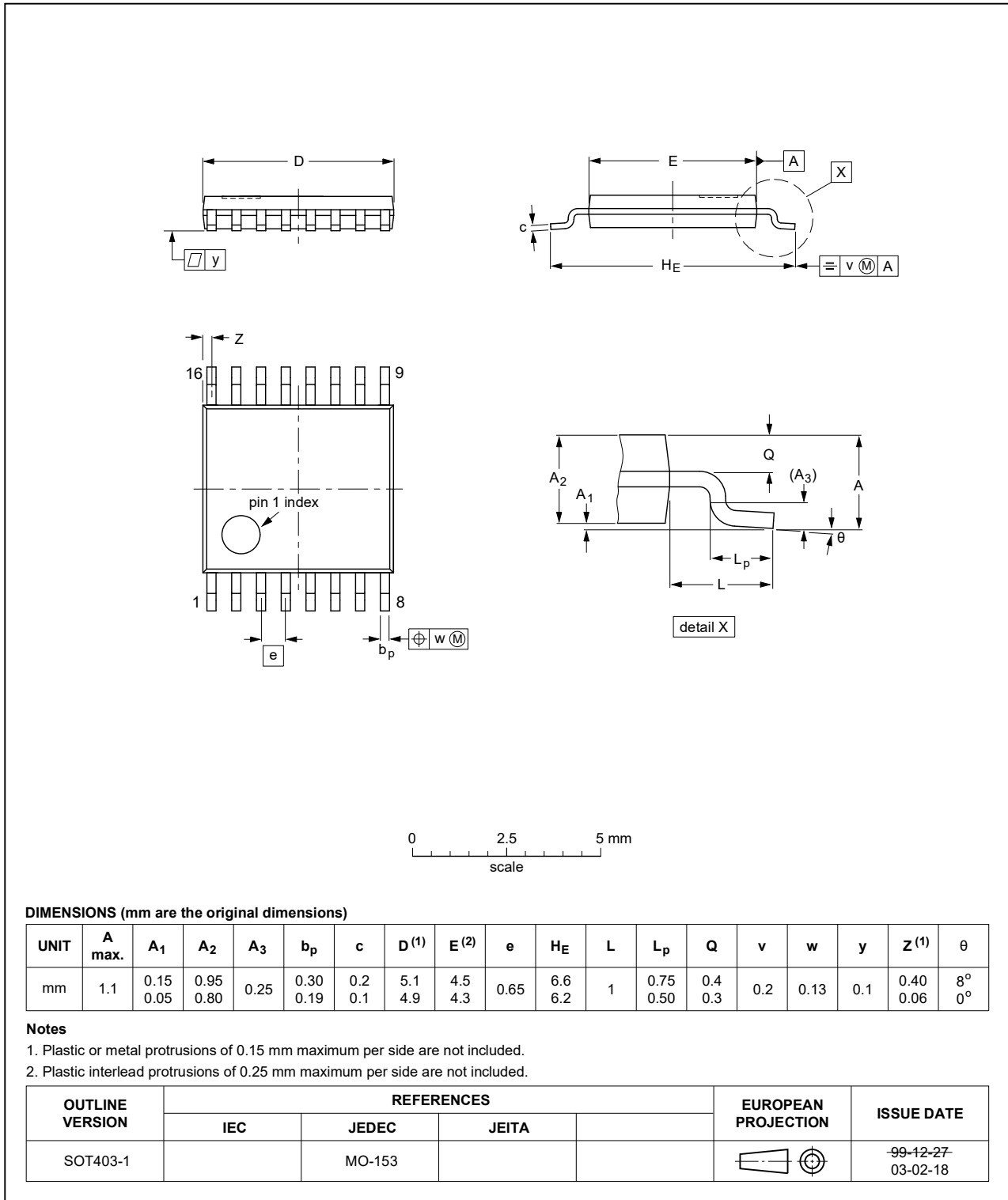


Fig. 17. Package outline SOT403-1 (TSSOP16)

## 13. Abbreviations

Table 12. Abbreviations

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

## 14. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT594 v.6	20211022	Product data sheet	-	74HC_HCT594 v.5
Modifications:	<ul style="list-style-type: none"> <li>Type number 74HCT594PW (SOT403-1/TSSOP16) added.</li> </ul>			
74HC_HCT594 v.5	20210812	Product data sheet	-	74HC_HCT594 v.4
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li>Type numbers 74HC594PW (SOT403-1/TSSOP16) added.</li> <li><a href="#">Section 8</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li> </ul>			
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</a>: Ordering information updated.</li> </ul>			
74HC_HCT594_CNV v.2	19970908	Product specification	-	74HC_HCT594_CNV v.1

## 15. Legal information

### Data sheet status

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

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
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## Contents

<b>1. General description</b> .....	<b>1</b>
<b>2. Features and benefits</b> .....	<b>1</b>
<b>3. Applications</b> .....	<b>1</b>
<b>4. Ordering information</b> .....	<b>2</b>
<b>5. Functional diagram</b> .....	<b>2</b>
<b>6. Pinning information</b> .....	<b>4</b>
6.1. Pinning.....	4
6.2. Pin description.....	4
<b>7. Functional description</b> .....	<b>4</b>
<b>8. Limiting values</b> .....	<b>5</b>
<b>9. Recommended operating conditions</b> .....	<b>5</b>
<b>10. Static characteristics</b> .....	<b>6</b>
<b>11. Dynamic characteristics</b> .....	<b>9</b>
11.1. Waveforms and test circuit.....	12
<b>12. Package outline</b> .....	<b>16</b>
<b>13. Abbreviations</b> .....	<b>19</b>
<b>14. Revision history</b> .....	<b>19</b>
<b>15. Legal information</b> .....	<b>20</b>

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