

74HC594-Q100; 74HCT594-Q100

8-bit shift register with output register

Rev. 5 — 19 March 2023

Product data sheet

1. General description

The 74HC594-Q100; 74HCT594-Q100 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} .

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

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
 - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- 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-Q100: CMOS level
 - For 74HCT594-Q100: 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: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
 - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- DHVQFN package with Side-Wettable Flanks enabling Automatic Optical Inspection (AOI) of solder joints

3. Applications

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

4. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74HC594D-Q100 74HCT594D-Q100	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74HC594PW-Q100	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
74HC594BQ-Q100	-40 °C to +125 °C	DHVQFN16	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 × 3.5 × 0.85 mm	SOT763-1

5. Functional diagram

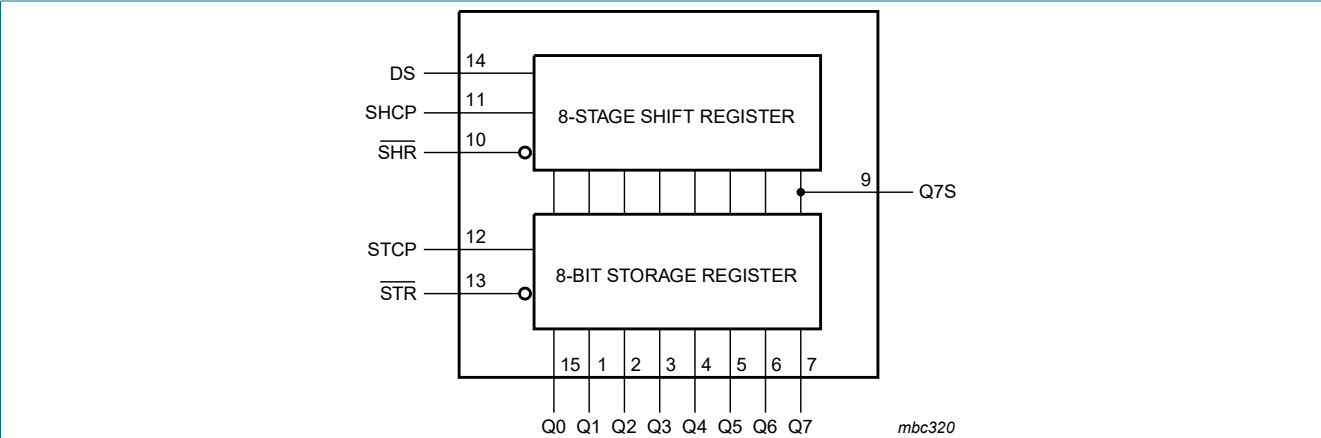


Fig. 1. Functional diagram

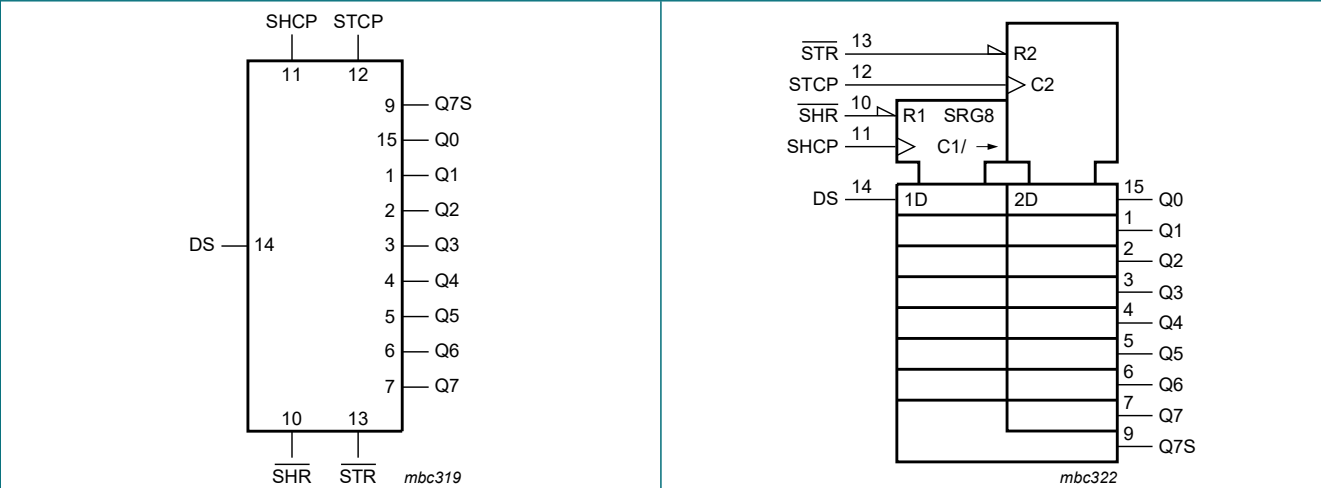


Fig. 2. Logic symbol

Fig. 3. IEC logic symbol

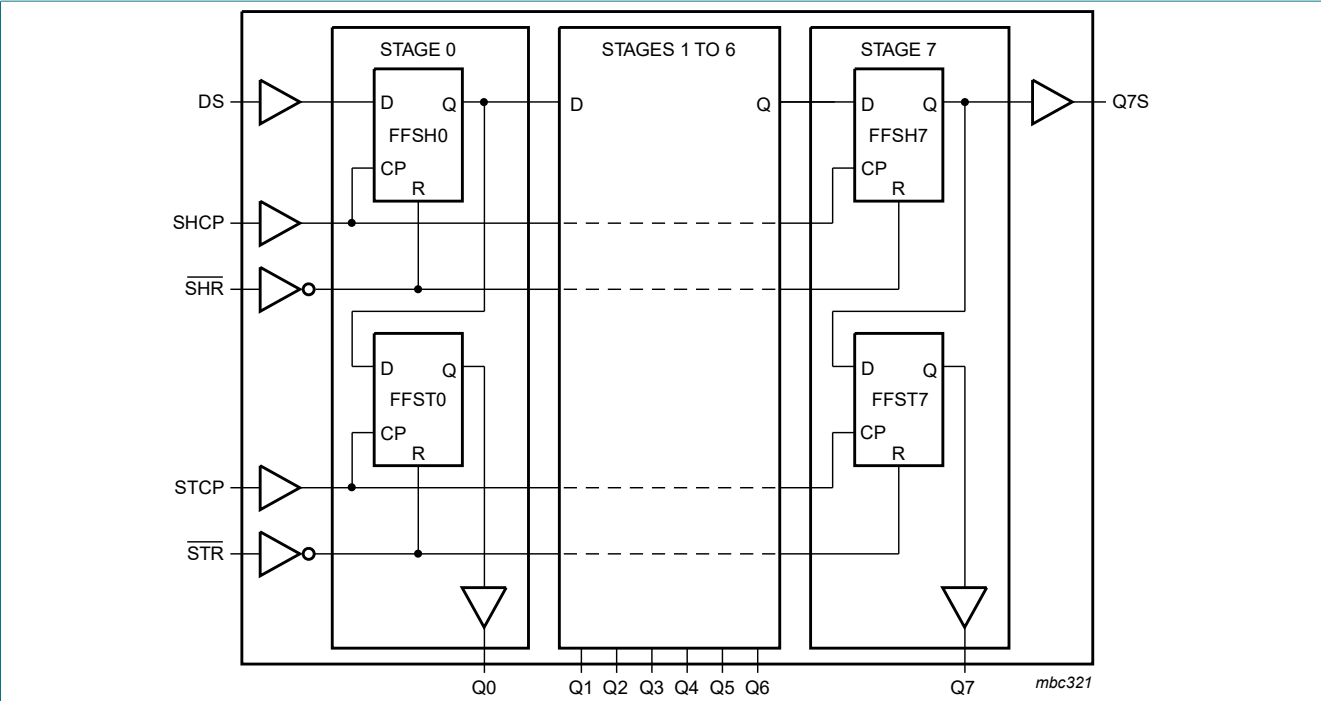


Fig. 4. Logic diagram

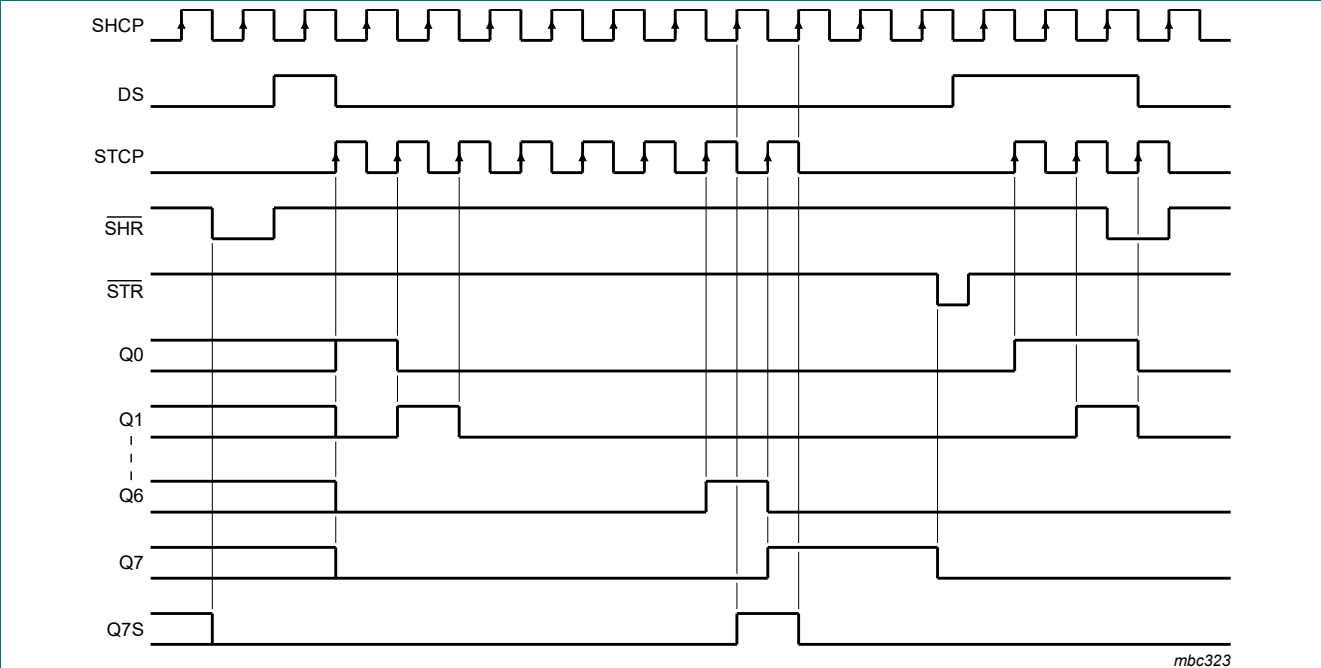
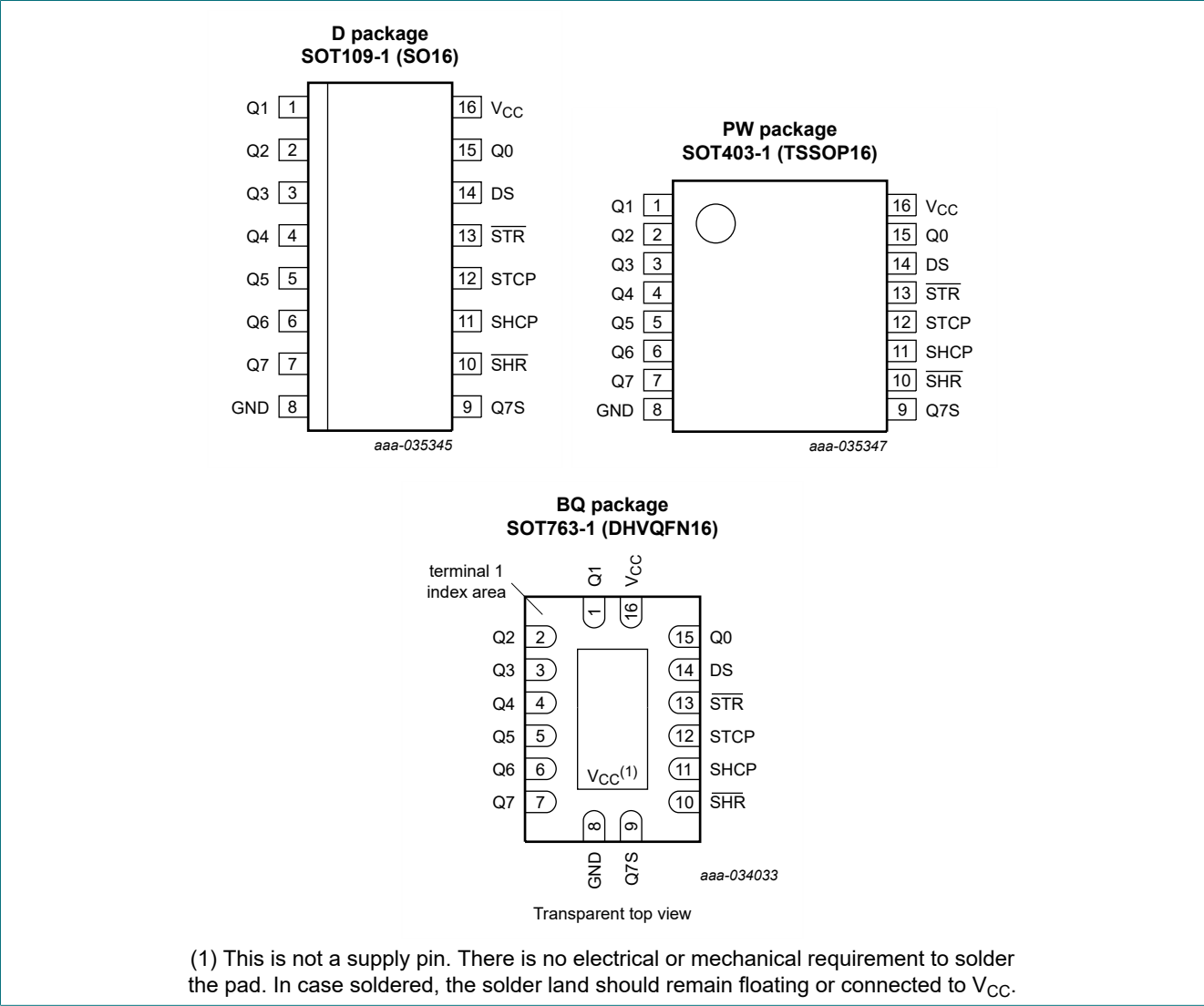


Fig. 5. Timing diagram

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 _{CC}	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 V or V _I > V _{CC} + 0.5 V [1]	-	±20	mA
I _{OK}	output clamping current	V _O < -0.5 V or V _O > V _{CC} + 0.5 V [1]	-	±20	mA
I _O	output current	V _O = -0.5 V to V _{CC} + 0.5 V			
		Serial data output Q7S	-	±25	mA
		Parallel data output Qn	-	±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 °C to +125 °C [2]	-	500	mW

- [1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
[2] For SOT109-1 (SO16) package: P_{tot} derates linearly with 12.4 mW/K above 110 °C.
For SOT403-1 (TSSOP16) package: P_{tot} derates linearly with 8.5 mW/K above 91 °C.
For SOT763-1 (DHVQFN16) package: P_{tot} derates linearly with 11.2 mW/K above 106 °C.

9. Recommended operating conditions

Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	74HC594-Q100			74HCT594-Q100			Unit
			Min	Typ	Max	Min	Typ	Max	
V _{CC}	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
V _I	input voltage		0	-	V _{CC}	0	-	V _{CC}	V
V _O	output voltage		0	-	V _{CC}	0	-	V _{CC}	V
T _{amb}	ambient temperature		-40	-	+125	-40	-	+125	°C
Δt/ΔV	input transition rise and fall rate	V _{CC} = 2.0 V	-	-	625	-	-	-	ns/V
		V _{CC} = 4.5 V	-	1.67	139	-	1.67	139	ns/V
		V _{CC} = 6.0 V	-	-	83	-	-	-	ns/V

10. Static characteristics

Table 6. Static characteristics type 74HC594-Q100

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{amb} = 25 °C						
V _{IH}	HIGH-level input voltage	V _{CC} = 2.0 V	1.5	1.2	-	V
		V _{CC} = 4.5 V	3.15	2.4	-	V
		V _{CC} = 6.0 V	4.2	3.2	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 2.0 V	-	0.8	0.5	V
		V _{CC} = 4.5 V	-	2.1	1.35	V
		V _{CC} = 6.0 V	-	2.8	1.8	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL}				
		Q7S; I _O = -4.0 mA; V _{CC} = 4.5 V	3.98	4.32	-	V
		Q7S; I _O = -5.2 mA; V _{CC} = 6.0 V	5.48	5.81	-	V
		Qn; I _O = -6.0 mA; V _{CC} = 4.5 V	3.98	4.32	-	V
		Qn; I _O = -7.8 mA; V _{CC} = 6.0 V	5.48	5.81	-	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}				
		Q7S; I _O = 4.0 mA; V _{CC} = 4.5 V	-	0.15	0.26	V
		Q7S; I _O = 5.2 mA; V _{CC} = 6.0 V	-	0.16	0.26	V
		Qn; I _O = 6.0 mA; V _{CC} = 4.5 V	-	0.15	0.26	V
		Qn; I _O = 7.8 mA; V _{CC} = 6.0 V	-	0.16	0.26	V
I _I	input leakage current	V _I = V _{CC} or GND; V _{CC} = 6.0 V	-	-	±0.1	μA
I _{CC}	supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 6.0 V	-	-	8.0	μA
C _i	input capacitance		-	3.5	-	pF
T_{amb} = -40 °C to +85 °C						
V _{IH}	HIGH-level input voltage	V _{CC} = 2.0 V	1.5	-	-	V
		V _{CC} = 4.5 V	3.15	-	-	V
		V _{CC} = 6.0 V	4.2	-	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 2.0 V	-	-	0.5	V
		V _{CC} = 4.5 V	-	-	1.35	V
		V _{CC} = 6.0 V	-	-	1.8	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL}				
		Q7S; I _O = -4.0 mA; V _{CC} = 4.5 V	3.84	-	-	V
		Q7S; I _O = -5.2 mA; V _{CC} = 6.0 V	5.34	-	-	V
		Qn; I _O = -6.0 mA; V _{CC} = 4.5 V	3.84	-	-	V
		Qn; I _O = -7.8 mA; V _{CC} = 6.0 V	5.34	-	-	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}				
		Q7S; I _O = 4.0 mA; V _{CC} = 4.5 V	-	-	0.33	V
		Q7S; I _O = 5.2 mA; V _{CC} = 6.0 V	-	-	0.33	V
		Qn; I _O = 6.0 mA; V _{CC} = 4.5 V	-	-	0.33	V
		Qn; I _O = 7.8 mA; V _{CC} = 6.0 V	-	-	0.33	V
I _I	input leakage current	V _I = V _{CC} or GND; V _{CC} = 6.0 V	-	-	±1.0	μA
I _{CC}	supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 6.0 V	-	-	80	μA

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{amb} = -40 °C to +125 °C						
V _{IH}	HIGH-level input voltage	V _{CC} = 2.0 V	1.5	-	-	V
		V _{CC} = 4.5 V	3.15	-	-	V
		V _{CC} = 6.0 V	4.2	-	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 2.0 V	-	-	0.5	V
		V _{CC} = 4.5 V	-	-	1.35	V
		V _{CC} = 6.0 V	-	-	1.8	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL}				
		Q7S; I _O = -4.0 mA; V _{CC} = 4.5 V	3.7	-	-	V
		Q7S; I _O = -5.2 mA; V _{CC} = 6.0 V	5.2	-	-	V
		Qn; I _O = -6.0 mA; V _{CC} = 4.5 V	3.7	-	-	V
		Qn; I _O = -7.8 mA; V _{CC} = 6.0 V	5.2	-	-	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}				
		Q7S; I _O = 4.0 mA; V _{CC} = 4.5 V	-	-	0.4	V
		Q7S; I _O = 5.2 mA; V _{CC} = 6.0 V	-	-	0.4	V
		Qn; I _O = 6.0 mA; V _{CC} = 4.5 V	-	-	0.4	V
		Qn; I _O = 7.8 mA; V _{CC} = 6.0 V	-	-	0.4	V
I _I	input leakage current	V _I = V _{CC} or GND; V _{CC} = 6.0 V	-	-	±1.0	µA
I _{CC}	supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 6.0 V	-	-	160	µA

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

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

11. Dynamic characteristics

Table 8. Dynamic characteristics type 74HC594-Q100

$GND = 0\text{ V}$; $t_r = t_f = 6\text{ ns}$; $C_L = 50\text{ pF}$; For test circuit see [Fig. 12](#).

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 Fig. 6 [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 Fig. 7								
		$V_{CC} = 2.0\text{ V}$	-	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 Fig. 10								
		$V_{CC} = 2.0\text{ V}$	-	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 Fig. 11								
		$V_{CC} = 2.0\text{ V}$	-	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 Fig. 6								
		$V_{CC} = 2.0\text{ V}$	-	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 Fig. 6								
		$V_{CC} = 2.0\text{ V}$	-	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_W	pulse width	SHCP (HIGH or LOW); see Fig. 6								
		$V_{CC} = 2.0\text{ V}$	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 Fig. 7								
		$V_{CC} = 2.0\text{ V}$	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 Fig. 10 and Fig. 11								
		$V_{CC} = 2.0\text{ V}$	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 Fig. 8								
		$V_{CC} = 2.0\text{ V}$	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 Fig. 9								
		$V_{CC} = 2.0\text{ V}$	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 Fig. 7								
		$V_{CC} = 2.0\text{ V}$	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 Fig. 8								
		$V_{CC} = 2.0\text{ V}$	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 Fig. 10 and Fig. 11								
		$V_{CC} = 2.0\text{ V}$	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

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
f _{max}	maximum frequency	SHCP or STCP; see Fig. 6 and Fig. 7								
		V _{CC} = 2.0 V	6.0	30	-	4.8	-	4.0	-	MHz
		V _{CC} = 4.5 V	30	92	-	24	-	20	-	MHz
		V _{CC} = 5.0 V; C _L = 15 pF	-	100	-	-	-	-	-	MHz
		V _{CC} = 6.0 V	35	109	-	28	-	24	-	MHz
C _{PD}	power dissipation capacitance	V _I = GND to V _{CC} ; V _{CC} = 5 V; [2] f _i = 1 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 μW):

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

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

Table 9. Dynamic characteristics type 74HCT594-Q100

GND = 0 V; V_{CC} = 4.5 V; t_r = t_f = 6 ns; C_L = 50 pF; For test circuit see Fig. 12.

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 Fig. 6 [1]	-	18	32	-	40	-	48	ns
		V _{CC} = 5.0 V; C _L = 15 pF	-	15	-	-	-	-	-	ns
		STCP to Qn; see Fig. 7	-	18	32	-	40	-	48	ns
		V _{CC} = 5.0 V; C _L = 15 pF	-	15	-	-	-	-	-	ns
t _{PHL}	HIGH to LOW propagation delay	SHR to Q7S; see Fig. 10	-	17	30	-	38	-	45	ns
		V _{CC} = 5.0 V; C _L = 15 pF	-	14	-	-	-	-	-	ns
		STR to Qn; see Fig. 11	-	17	30	-	38	-	45	ns
		V _{CC} = 5.0 V; C _L = 15 pF	-	14	-	-	-	-	-	ns
t _{THL}	HIGH to LOW output transition time	Q7S; see Fig. 6								
		V _{CC} = 4.5 V	-	7	15	-	19	-	22	ns
		Qn								
		V _{CC} = 4.5 V	-	5	12	-	15	-	18	ns
t _{TLH}	LOW to HIGH output transition time	Q7S; see Fig. 6								
		V _{CC} = 4.5 V	-	7	15	-	19	-	22	ns
		Qn								
		V _{CC} = 4.5 V	-	5	12	-	15	-	18	ns
t _w	pulse width	SHCP (HIGH or LOW); see Fig. 6	16	4	-	20	-	24	-	ns
		STCP (HIGH or LOW); see Fig. 7	16	4	-	20	-	24	-	ns
		SHR and STR (HIGH or LOW); see Fig. 10 and Fig. 11	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 _{su}	set-up time	DS to SHCP; see Fig. 8	20	4	-	25	-	30	-	ns
		SHR to STCP; see Fig. 9	20	6	-	25	-	30	-	ns
		SHCP to STCP; see Fig. 7	20	7	-	25	-	30	-	ns
t _h	hold time	DS to SHCP; see Fig. 8	5	-3	-	6	-	7	-	ns
t _{rec}	recovery time	SHR to SHCP and STR to STCP; see Fig. 10 and Fig. 11	10	-5	-	13	-	15	-	ns
f _{max}	maximum frequency	SHCP or STCP; see Fig. 6 and Fig. 7	30	92	-	24	-	20	-	MHz
		V _{CC} = 5.0 V; C _L = 15 pF	-	100	-	-	-	-	-	MHz
C _{PD}	power dissipation capacitance	V _I = GND to V _{CC} - 1.5 V; V _{CC} = 5 V; f _i = 1 MHz [2]	-	89	-	-	-	-	-	pF

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

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

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

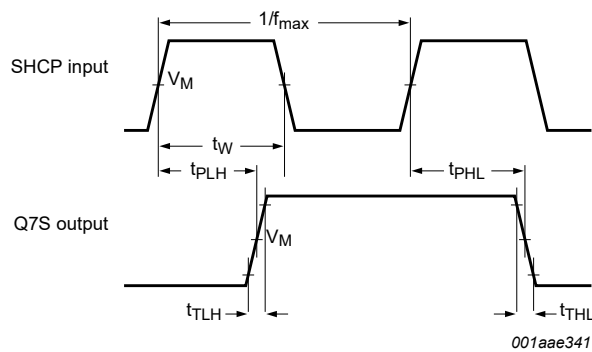
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

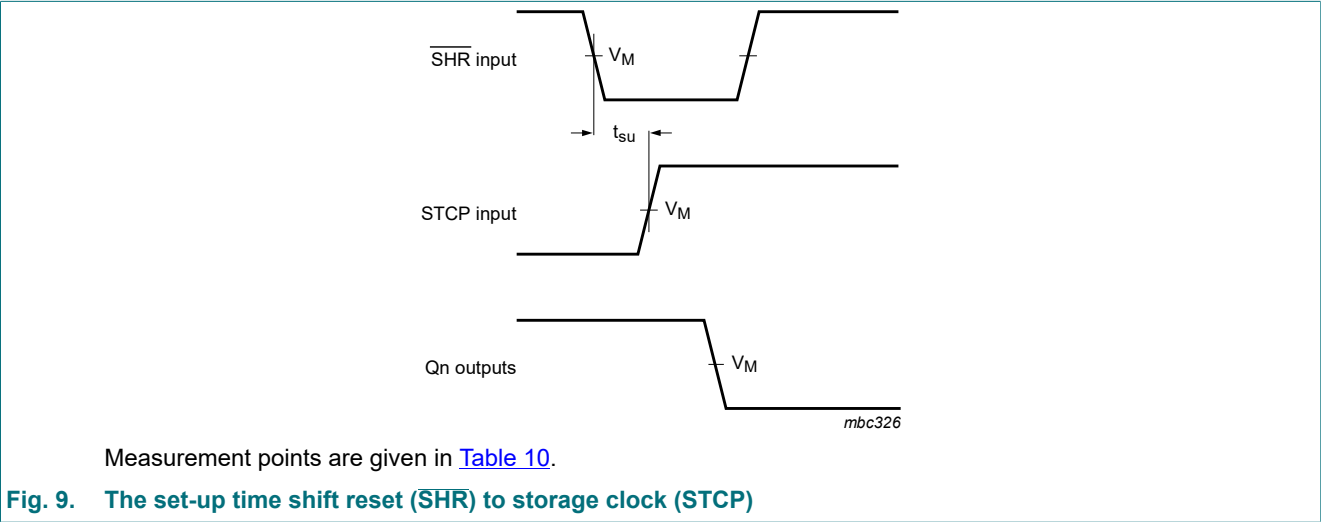
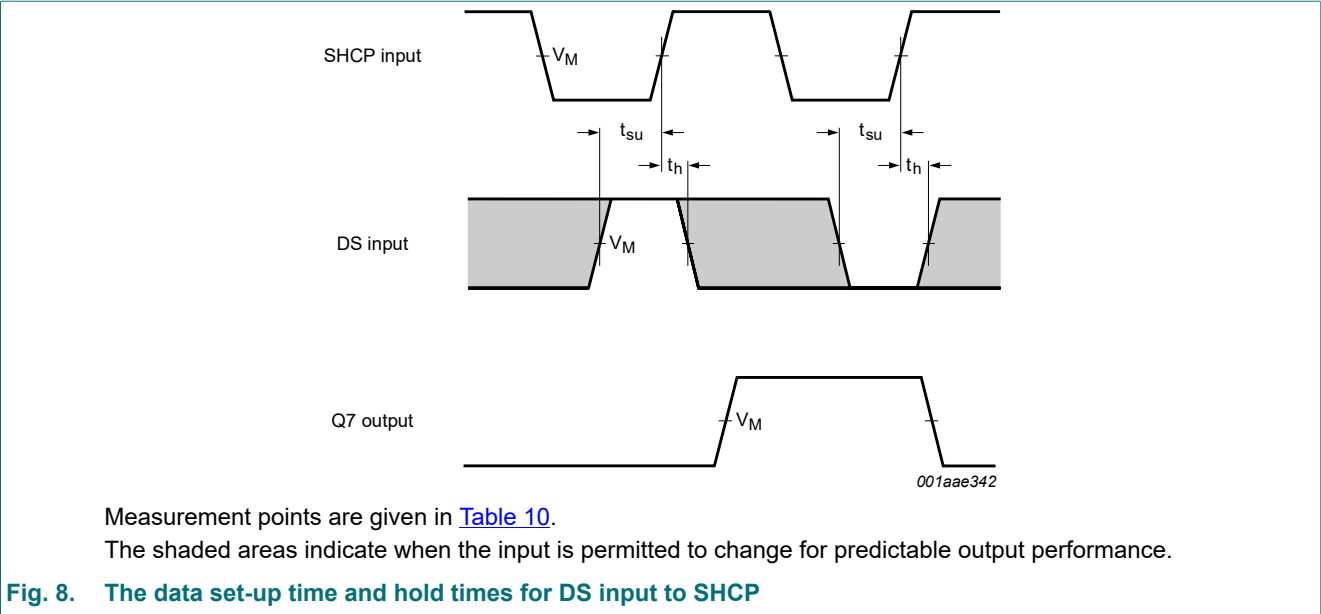
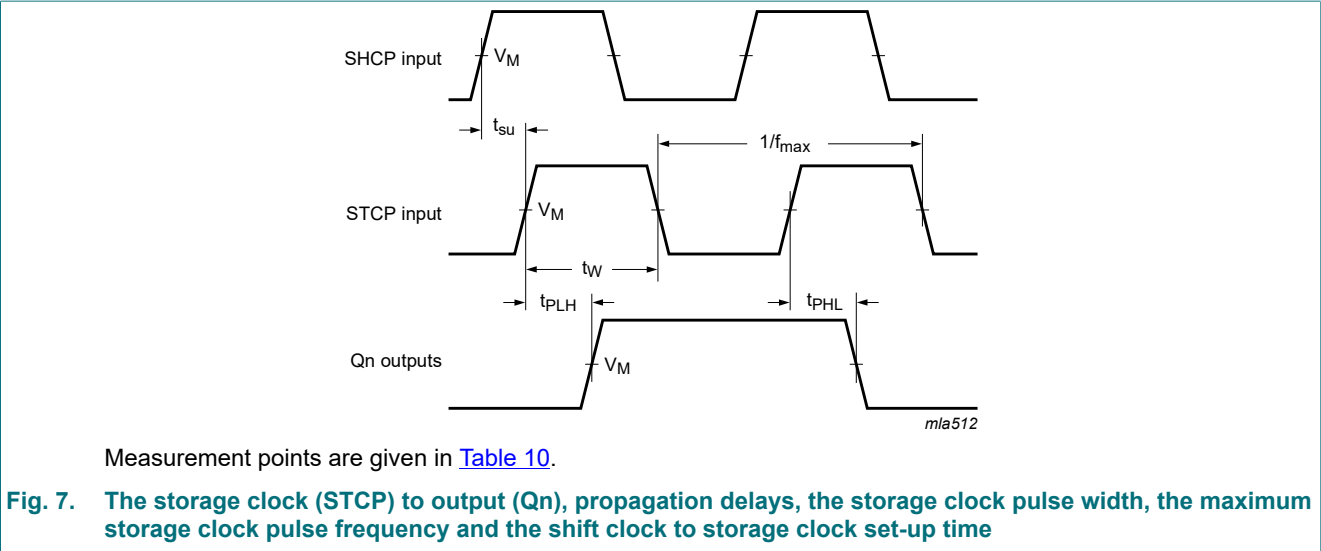
∑(C_L × V_{CC}² × f_o) = sum of outputs.

11.1. Waveforms and test circuit



Measurement points are given in Table 10.

Fig. 6. The shift clock (SHCP) to output (Q7S) propagation delays, the shift clock pulse width, the maximum shift clock frequency, and output transition times



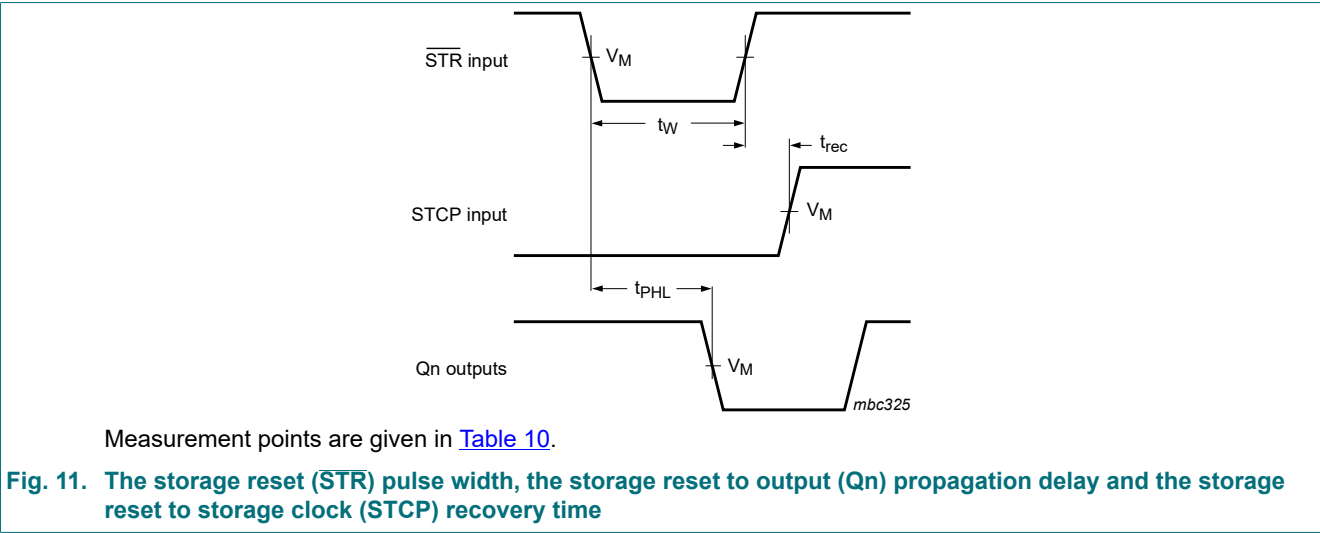
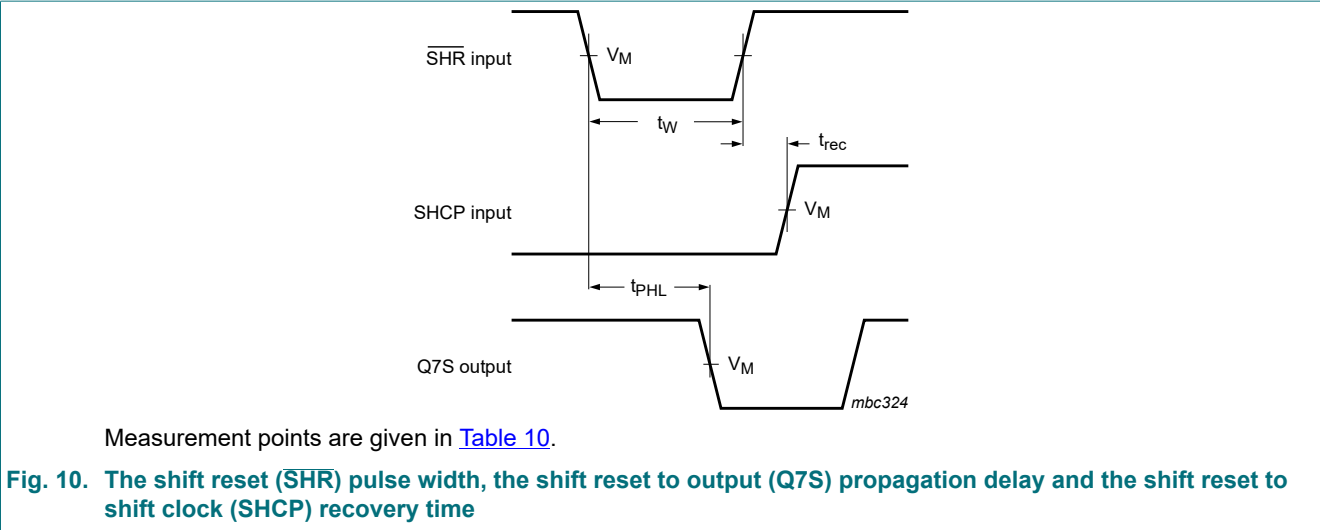


Table 10. Measurement points

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

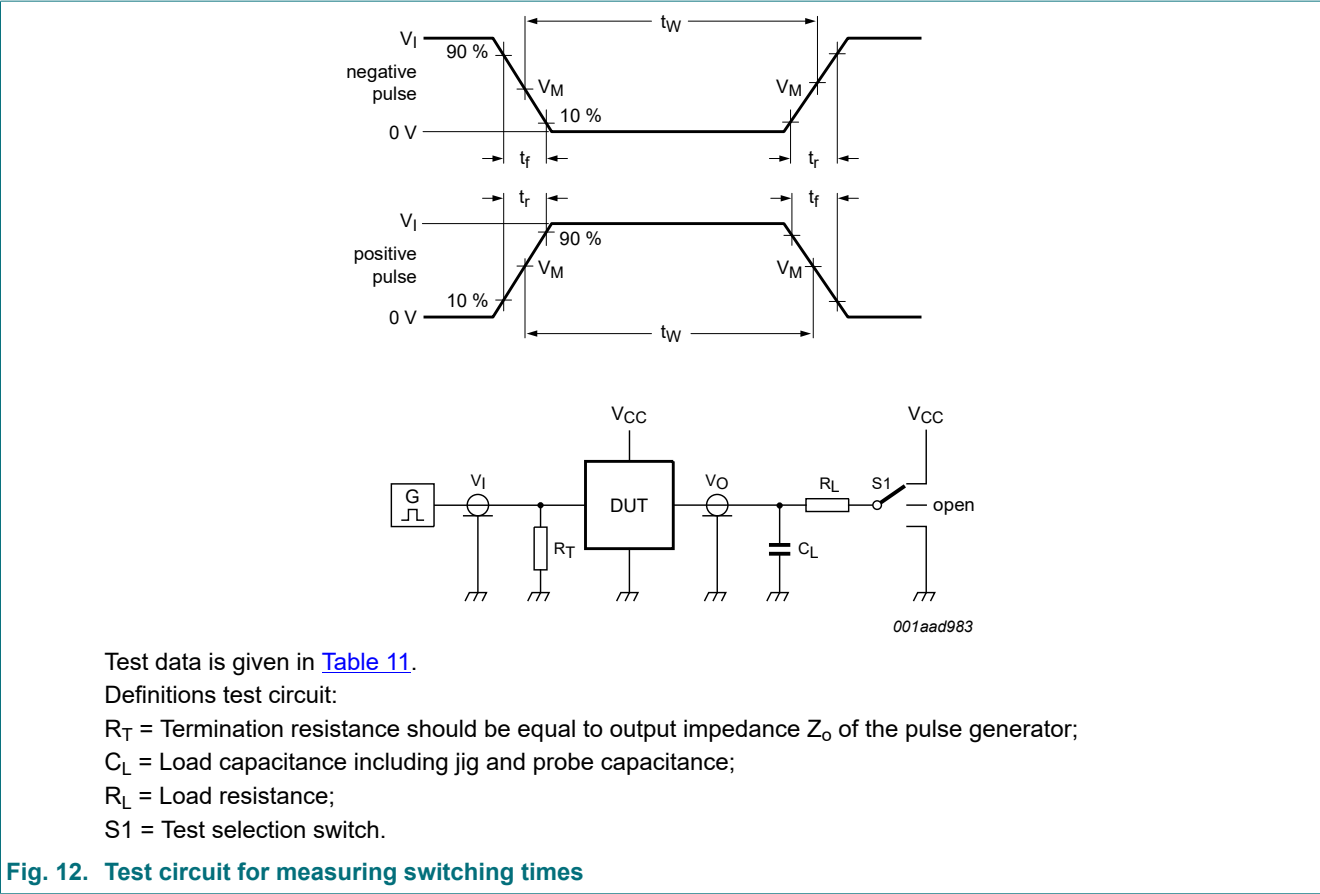


Table 11. Test data

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 Ω	open	GND	V_{CC}
74HCT594-Q100	3 V	6 ns	15 pF, 50 pF	1 k Ω	open	GND	V_{CC}

12. Package outline

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

SOT109-1

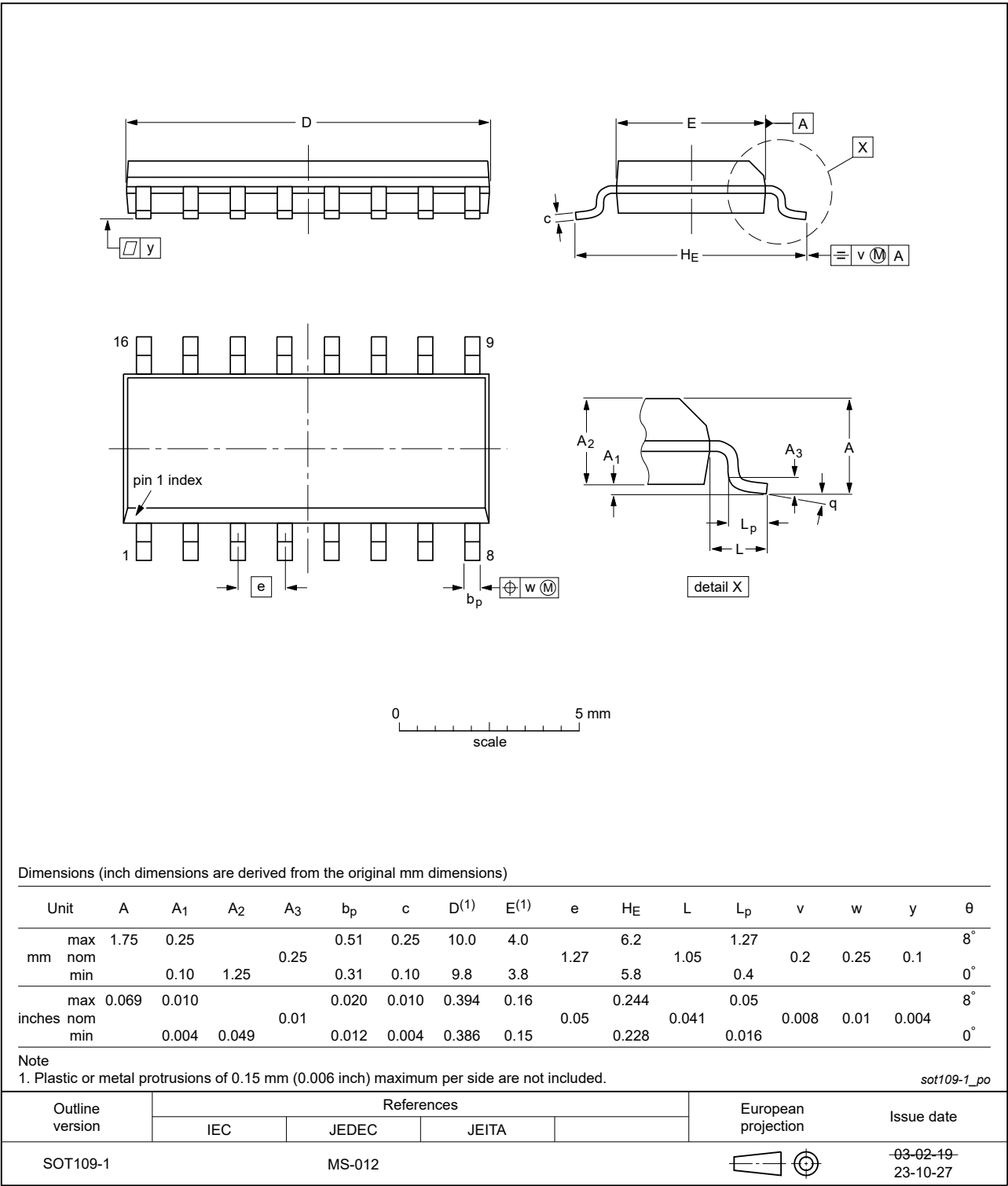


Fig. 13. Package outline SOT109-1 (SO16)

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

SOT403-1

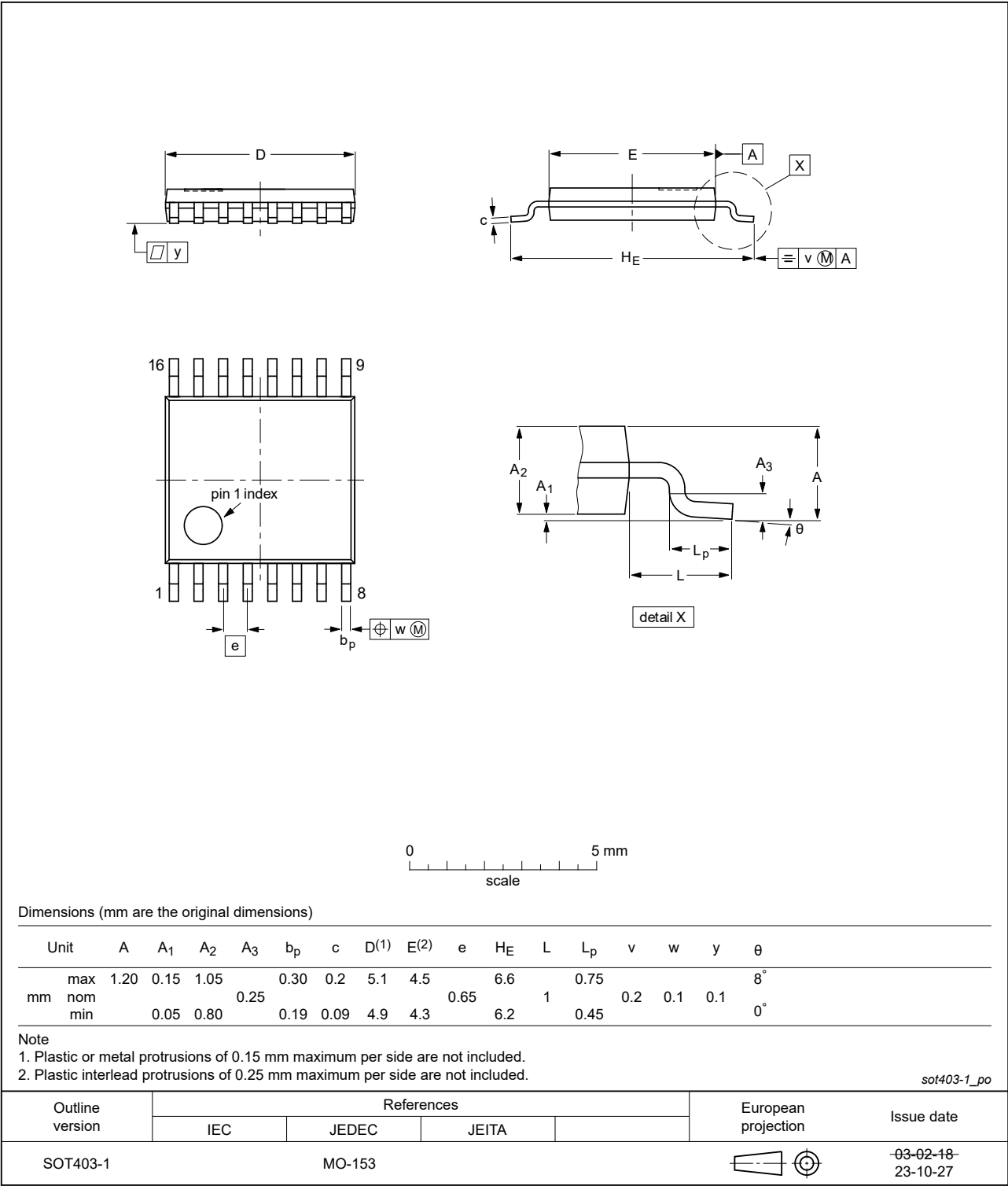


Fig. 14. Package outline SOT403-1 (TSSOP16)

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

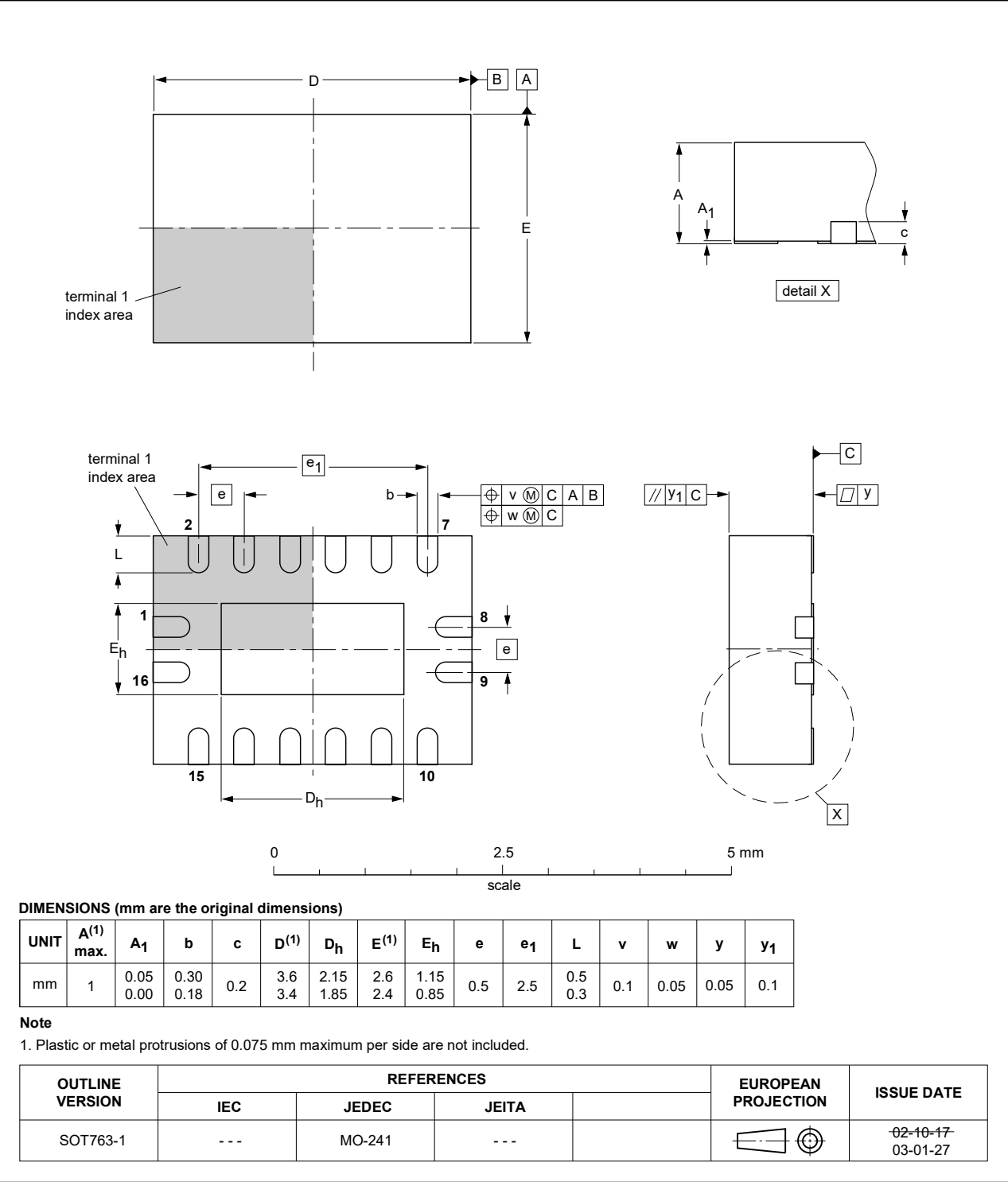


Fig. 15. Package outline SOT763-1 (DHVQFN16)

13. Abbreviations

Table 12. 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

14. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT594_Q100 v.5	20240319	Product data sheet	-	74HC_HCT594_Q100 v.4
Modifications:	- Section 2: ESD specification updated according to the latest JEDEC standard. - Fig. 13 and Fig. 14: Aligned SO and TSSOP package outline drawings to JEDEC MS-012 and MO-153.			
74HC_HCT594_Q100 v.4	20220927	Product data sheet	-	74HC_HCT594_Q100 v.3
Modifications:	Type number 74HC594BQ-Q100 (SOT763-1/DHVQFN16) added.			
74HC_HCT594_Q100 v.3	20210812	Product data sheet	-	74HC_HCT594_Q100 v.2
Modifications:	- The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. - Legal texts have been adapted to the new company name where appropriate. - Section 1 and Section 2 updated. - Section 8: Derating values for P_{tot} total power dissipation updated. - Section 9: rise time and fall time replaced by input transition rise and fall rate.			
74HC_HCT594_Q100 v.2	20160613	Product data sheet	-	74HC_HCT594_Q100 v.1
Modifications:	Added type number 74HC594PW-Q100 (SOT403-1).			
74HC_HCT594_Q100 v.1	20120802	Product data sheet	-	-

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".
- [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 <https://www.nexperia.com>.

Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. Nexperia does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local Nexperia sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between Nexperia and its customer, unless Nexperia and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the Nexperia product is deemed to offer functions and qualities beyond those described in the Product data sheet.

Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, Nexperia does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. Nexperia takes no responsibility for the content in this document if provided by an information source outside of Nexperia.

In no event shall Nexperia be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, Nexperia's aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms and conditions of commercial sale of Nexperia.

Right to make changes — Nexperia reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use in automotive applications — This Nexperia product has been qualified for use in automotive applications. Unless otherwise agreed in writing, the product is not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or

equipment, nor in applications where failure or malfunction of an Nexperia product can reasonably be expected to result in personal injury, death or severe property or environmental damage. Nexperia and its suppliers accept no liability for inclusion and/or use of Nexperia products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Quick reference data — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. Nexperia makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using Nexperia products, and Nexperia accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the Nexperia product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

Nexperia does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using Nexperia products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). Nexperia does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — Nexperia products are sold subject to the general terms and conditions of commercial sale, as published at <http://www.nexperia.com/profile/terms>, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. Nexperia hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of Nexperia products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Translations — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

Contents

1. General description	1
2. Features and benefits	1
3. Applications	1
4. Ordering information	2
5. Functional diagram	2
6. Pinning information	4
6.1. Pinning	4
6.2. Pin description	5
7. Functional description	5
8. Limiting values	6
9. Recommended operating conditions	6
10. Static characteristics	7
11. Dynamic characteristics	10
11.1. Waveforms and test circuit	13
12. Package outline	17
13. Abbreviations	20
14. Revision history	20
15. Legal information	21

© Nexperia B.V. 2024. All rights reserved

For more information, please visit: <http://www.nexperia.com>

For sales office addresses, please send an email to: salesaddresses@nexperia.com

Date of release: 19 March 2023