

74HC4094-Q100; 74HCT4094-Q100

8-stage shift-and-store bus register

Rev. 4 — 21 March 2024

Product data sheet

1. General description

The 74HC4094-Q100; 74HCT4094-Q100 is an 8-bit serial-in/serial or parallel-out shift register with a storage register and 3-state outputs. Both the shift and storage register have separate clocks. The device features a serial input (D) and two serial outputs (QS1 and QS2) to enable cascading. Data is shifted on the LOW-to-HIGH transitions of the CP input. Data is available at QS1 on the LOW-to-HIGH transitions of the CP input to allow cascading when clock edges are fast. The same data is available at QS2 on the next HIGH-to-LOW transition of the CP input to allow cascading when clock edges are slow. The data in the shift register is transferred to the storage register when the STR input is HIGH. Data in the storage register appears at the outputs whenever the output enable input (OE) is HIGH. A LOW on OE causes the outputs to assume a high-impedance OFF-state. Operation of the OE input does not affect the state of the registers. 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
- Complies with JEDEC standard JESD7A
- Input levels:
 - For 74HC4094-Q100: CMOS level
 - For 74HCT4094-Q100: TTL level
- Low-power dissipation
- ESD protection:
 - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
 - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V

3. Applications

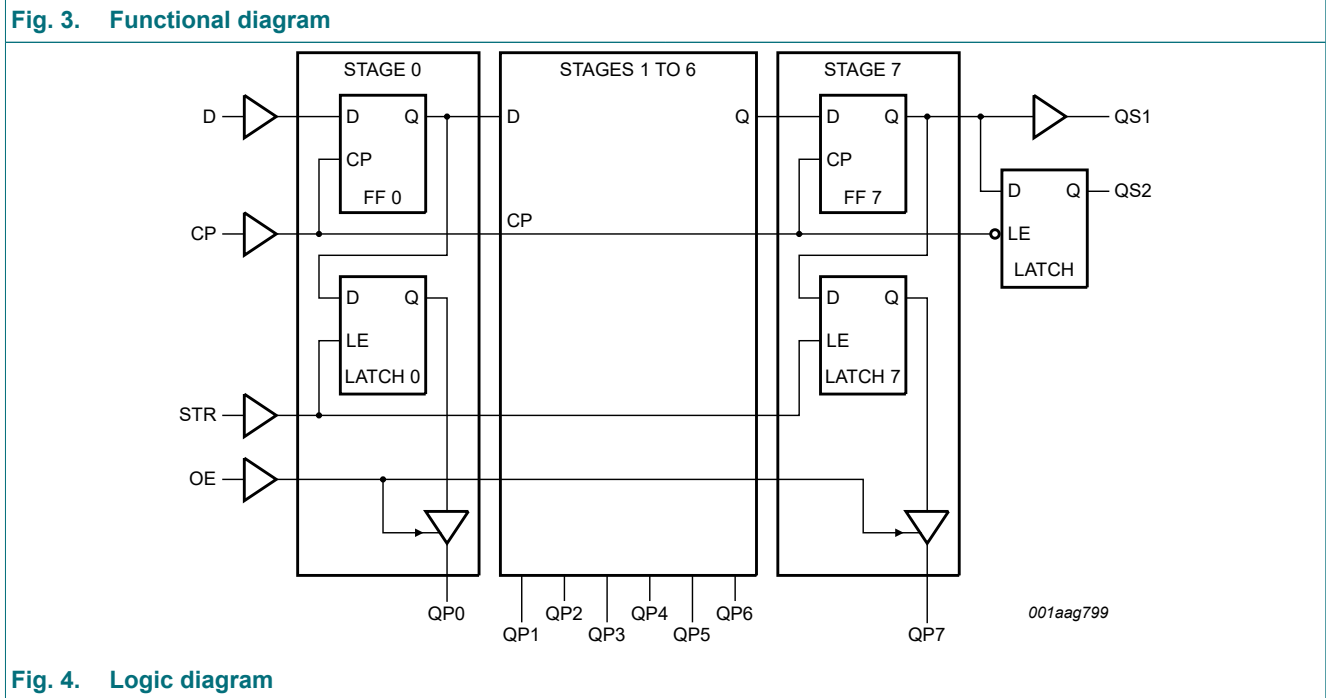
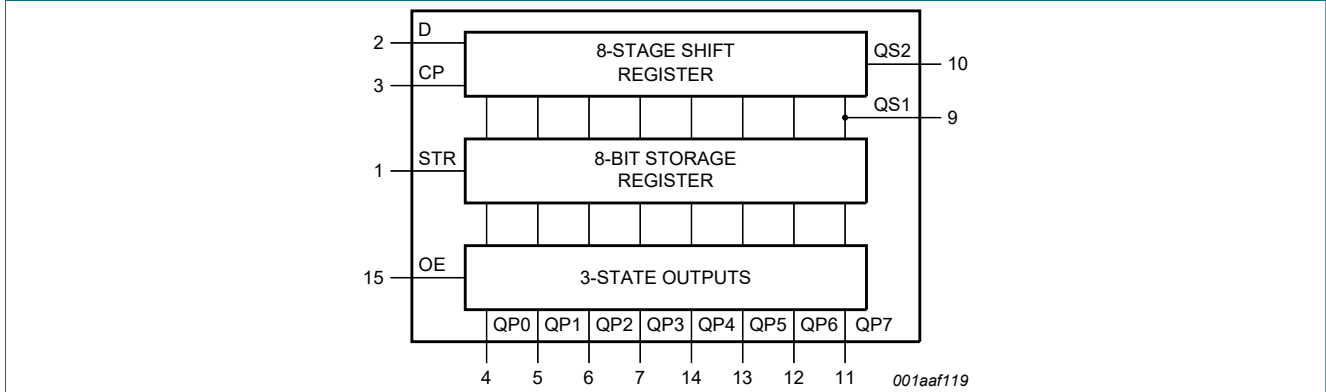
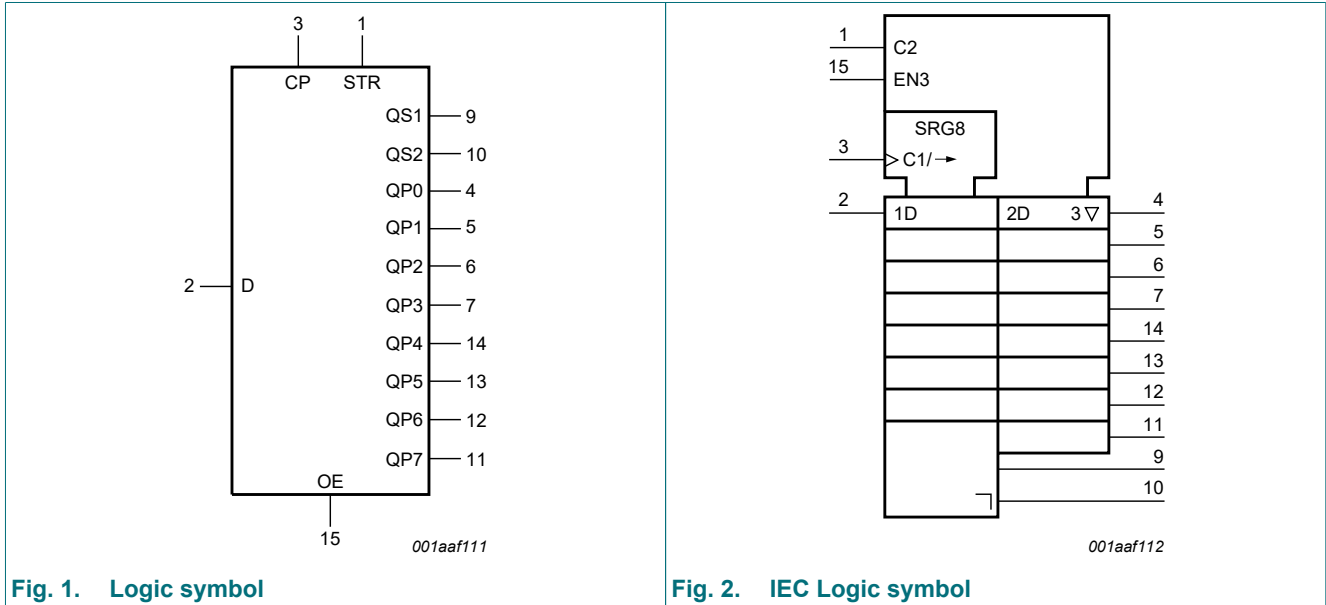
- Serial-to-parallel data conversion
- Remote control holding register

4. Ordering information

Table 1. Ordering information

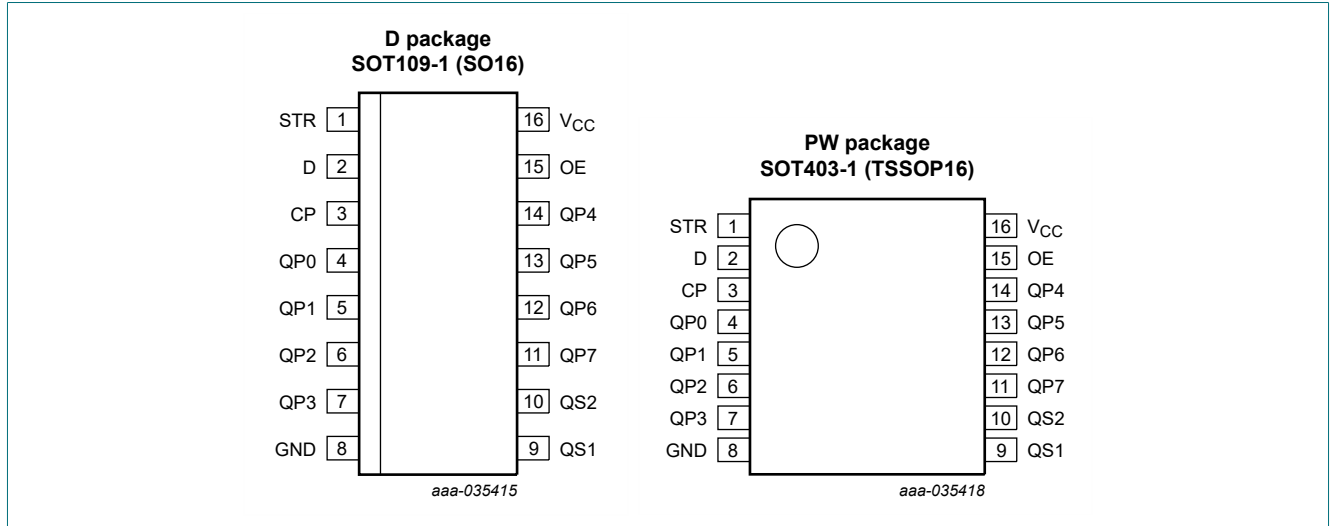
Type number	Package			Version
	Temperature range	Name	Description	
74HC4094D-Q100 74HCT4094D-Q100	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74HC4094PW-Q100	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1

5. Functional diagram



6. Pinning information

6.1. Pinning



6.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
STR	1	strobe input
D	2	data input
CP	3	clock input
QP0, QP1, QP2, QP3, QP4, QP5, QP6, QP7	4, 5, 6, 7, 14, 13, 12, 11	parallel output
GND	8	ground supply voltage
QS1, QS2	9, 10	serial output
OE	15	output enable input
V _{CC}	16	supply voltage

7. Functional description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = HIGH-impedance OFF-state; NC = no change;
 ↑ = positive-going transition; ↓ = negative-going transition;
 Q6S = the data in register stage 6 before the LOW to HIGH clock transition;
 Q7S = the data in register stage 7 before the HIGH to LOW clock transition.

Inputs				Parallel outputs		Serial outputs	
CP	OE	STR	D	QP0	QPn	QS1	QS2
↑	L	X	X	Z	Z	Q6S	NC
↓	L	X	X	Z	Z	NC	Q7S
↑	H	L	X	NC	NC	Q6S	NC
↑	H	H	L	L	QPn - 1	Q6S	NC
↑	H	H	H	H	QPn - 1	Q6S	NC
↓	H	H	H	NC	NC	NC	Q7S

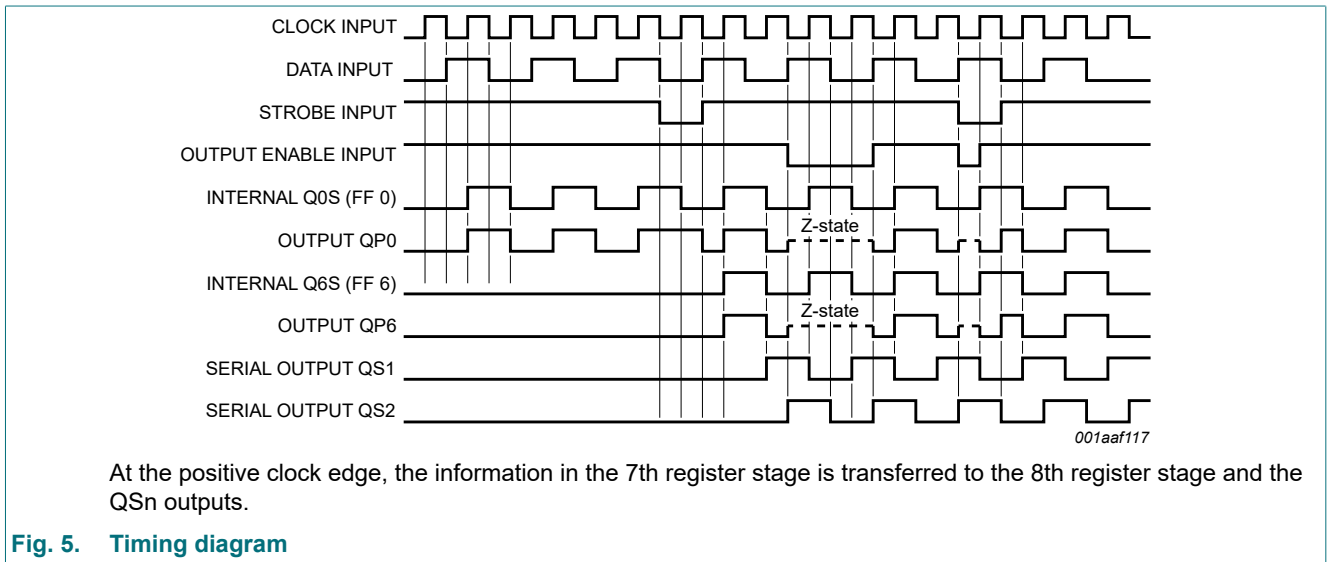


Fig. 5. Timing diagram

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	V
I_{IK}	input clamping current	$V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$	-	± 20	mA
I_{OK}	output clamping current	$V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$	-	± 20	mA
I_O	output current	$V_O = -0.5\text{ V}$ to $(V_{CC} + 0.5\text{ V})$	-	± 25	mA
I_{CC}	supply current		-	+50	mA
I_{GND}	ground current		-	-50	mA
T_{stg}	storage temperature		-65	+150	°C
P_{tot}	total power dissipation	[1]	-	500	mW

- [1] 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.

9. Recommended operating conditions

Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V)

Symbol	Parameter	Conditions	74HC4094-Q100			74HCT4094-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	+25	+125	-40	+25	+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

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

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HC4094-Q100										
V _{IH}	HIGH-level input voltage	V _{CC} = 2.0 V	1.5	1.2	-	1.5	-	1.5	-	V
		V _{CC} = 4.5 V	3.15	2.4	-	3.15	-	3.15	-	V
		V _{CC} = 6.0 V	4.2	3.2	-	4.2	-	4.2	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 2.0 V	-	0.8	0.5	-	0.5	-	0.5	V
		V _{CC} = 4.5 V	-	2.1	1.35	-	1.35	-	1.35	V
		V _{CC} = 6.0 V	-	2.8	1.8	-	1.8	-	1.8	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL}								
		I _O = -20 μA; V _{CC} = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I _O = -20 μA; V _{CC} = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I _O = -20 μA; V _{CC} = 6.0 V	5.9	6.0	-	5.9	-	5.9	-	V
		I _O = -4.0 mA; V _{CC} = 4.5 V	3.98	4.32	-	3.84	-	3.7	-	V
		I _O = -5.2 mA; V _{CC} = 6.0 V	5.48	5.81	-	5.34	-	5.2	-	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}								
		I _O = 20 μA; V _{CC} = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 20 μA; V _{CC} = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 20 μA; V _{CC} = 6.0 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 4.0 mA; V _{CC} = 4.5 V	-	0.15	0.26	-	0.33	-	0.4	V
		I _O = 5.2 mA; V _{CC} = 6.0 V	-	0.16	0.26	-	0.33	-	0.4	V
I _I	input leakage current	V _I = V _{CC} or GND; V _{CC} = 6.0 V	-	-	±0.1	-	±1.0	-	±1.0	μA
I _{OZ}	OFF-state output current	V _I = V _{IH} or V _{IL} ; V _O = V _{CC} or GND; V _{CC} = 6.0 V	-	-	±0.5	-	±5.0	-	±10.0	μA
I _{CC}	supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 6.0 V	-	-	8.0	-	80	-	160	μA
C _I	input capacitance		-	3.5	-	-	-	-	-	pF

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HCT4094-Q100										
V _{IH}	HIGH-level input voltage	V _{CC} = 4.5 V to 5.5 V	2.0	1.6	-	2.0	-	2.0	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 4.5 V to 5.5 V	-	1.2	0.8	-	0.8	-	0.8	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V								
		I _O = -20 µA	4.4	4.5	-	4.4	-	4.4	-	V
		I _O = -4.0 mA	3.98	4.32	-	3.84	-	3.7	-	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V								
		I _O = 20 µA	-	0	0.1	-	0.1	-	0.1	V
		I _O = 4.0 mA	-	0.15	0.26	-	0.33	-	0.4	V
I _I	input leakage current	V _I = V _{CC} or GND; V _{CC} = 5.5 V	-	-	±0.1	-	±1.0	-	±1.0	µA
I _{OZ}	OFF-state output current	V _I = V _{IH} or V _{IL} ; V _O = V _{CC} or GND; V _{CC} = 5.5 V	-	-	±0.5	-	±5.0	-	±10	µA
I _{CC}	supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V	-	-	8.0	-	80	-	160	µA
ΔI _{CC}	additional supply current	V _I = V _{CC} - 2.1 V; other inputs at V _{CC} or GND; V _{CC} = 4.5 V to 5.5 V; I _O = 0 A								
		per input pin; STR input	-	100	360	-	450	-	490	µA
		per input pin; OE input	-	150	540	-	675	-	735	µA
		per input pin; CP input	-	150	540	-	675	-	735	µA
	per input pin; D input	-	40	144	-	180	-	196	µA	
C _I	input capacitance		-	3.5	-	-	-	-	-	pF

11. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); $C_L = 50$ pF unless otherwise specified; for test circuit see Fig. 10.

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HC4094-Q100										
t_{pd}	propagation delay	CP to QS1; see Fig. 6 [1]								
		$V_{CC} = 2.0$ V	-	50	150	-	190	-	225	ns
		$V_{CC} = 4.5$ V	-	18	30	-	38	-	45	ns
		$V_{CC} = 5$ V; $C_L = 15$ pF	-	15	-	-	-	-	-	ns
		$V_{CC} = 6.0$ V	-	14	26	-	33	-	38	ns
		CP to QS2; see Fig. 6 [1]								
		$V_{CC} = 2.0$ V	-	44	135	-	170	-	205	ns
		$V_{CC} = 4.5$ V	-	16	27	-	34	-	41	ns
		$V_{CC} = 5$ V; $C_L = 15$ pF	-	13	-	-	-	-	-	ns
		$V_{CC} = 6.0$ V	-	13	23	-	29	-	35	ns
		CP to QPn; see Fig. 6 [1]								
		$V_{CC} = 2.0$ V	-	63	195	-	245	-	295	ns
		$V_{CC} = 4.5$ V	-	23	39	-	49	-	59	ns
		$V_{CC} = 5$ V; $C_L = 15$ pF	-	20	-	-	-	-	-	ns
		$V_{CC} = 6.0$ V	-	18	33	-	42	-	50	ns
		STR to QPn; see Fig. 7 [1]								
$V_{CC} = 2.0$ V	-	58	180	-	225	-	270	ns		
$V_{CC} = 4.5$ V	-	21	36	-	45	-	54	ns		
$V_{CC} = 5$ V; $C_L = 15$ pF	-	18	-	-	-	-	-	ns		
$V_{CC} = 6.0$ V	-	17	31	-	38	-	46	ns		
t_{en}	enable time	OE to QPn; see Fig. 8 [1]								
		$V_{CC} = 2.0$ V	-	55	175	-	220	-	265	ns
		$V_{CC} = 4.5$ V	-	20	35	-	44	-	53	ns
		$V_{CC} = 6.0$ V	-	16	30	-	37	-	45	ns
t_{dis}	disable time	OE to QPn; see Fig. 8 [1]								
		$V_{CC} = 2.0$ V	-	41	125	-	155	-	190	ns
		$V_{CC} = 4.5$ V	-	15	25	-	31	-	38	ns
		$V_{CC} = 6.0$ V	-	12	21	-	26	-	32	ns
t_t	transition time	QPn and QSn; see Fig. 6 [1]								
		$V_{CC} = 2.0$ V	-	19	75	-	95	-	110	ns
		$V_{CC} = 4.5$ V	-	7	15	-	19	-	22	ns
		$V_{CC} = 6.0$ V	-	6	13	-	16	-	19	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	CP HIGH or LOW; see Fig. 6								
		V _{CC} = 2.0 V	80	14	-	100	-	120	-	ns
		V _{CC} = 4.5 V	16	5	-	20	-	24	-	ns
		V _{CC} = 6.0 V	14	4	-	17	-	20	-	ns
		STR HIGH; see Fig. 7								
		V _{CC} = 2.0 V	80	14	-	100	-	120	-	ns
		V _{CC} = 4.5 V	16	5	-	20	-	24	-	ns
V _{CC} = 6.0 V	14	4	-	17	-	20	-	ns		
t _{su}	set-up time	D to CP; see Fig. 9								
		V _{CC} = 2.0 V	50	14	-	65	-	75	-	ns
		V _{CC} = 4.5 V	10	5	-	13	-	15	-	ns
		V _{CC} = 6.0 V	9	4	-	11	-	13	-	ns
		CP to STR; see Fig. 7								
		V _{CC} = 2.0 V	100	28	-	125	-	150	-	ns
		V _{CC} = 4.5 V	20	10	-	25	-	30	-	ns
V _{CC} = 6.0 V	17	8	-	21	-	26	-	ns		
t _h	hold time	D to CP; see Fig. 9								
		V _{CC} = 2.0 V	3	-6	-	3	-	3	-	ns
		V _{CC} = 4.5 V	3	-2	-	3	-	3	-	ns
		V _{CC} = 6.0 V	3	-2	-	3	-	3	-	ns
		CP to STR; see Fig. 7								
		V _{CC} = 2.0 V	0	-14	-	0	-	0	-	ns
		V _{CC} = 4.5 V	0	-5	-	0	-	0	-	ns
V _{CC} = 6.0 V	0	-4	-	0	-	0	-	ns		
f _{max}	maximum frequency	CP; see Fig. 6								
		V _{CC} = 2.0 V	6.0	28	-	4.8	-	4.0	-	MHz
		V _{CC} = 4.5 V	30	87	-	24	-	20	-	MHz
		V _{CC} = 5 V; C _L = 15 pF	-	95	-	-	-	-	-	MHz
		V _{CC} = 6.0 V	35	103	-	28	-	24	-	MHz
C _{PD}	power dissipation capacitance	C _L = 50 pF; f = 1 MHz; V _I = GND to V _{CC} [2]	-	83	-	-	-	-	-	pF

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HCT4094-Q100										
t _{pd}	propagation delay	CP to QS1; see Fig. 6 [1]								
		V _{CC} = 4.5 V	-	23	39	-	49	-	59	ns
		V _{CC} = 5 V; C _L = 15 pF	-	19	-	-	-	-	-	ns
		CP to QS2; see Fig. 6 [1]								
		V _{CC} = 4.5 V	-	21	36	-	45	-	54	ns
		V _{CC} = 5 V; C _L = 15 pF	-	18	-	-	-	-	-	ns
		CP to QPn; see Fig. 6 [1]								
		V _{CC} = 4.5 V	-	25	43	-	54	-	65	ns
		V _{CC} = 5 V; C _L = 15 pF	-	21	-	-	-	-	-	ns
		STR to QPn; see Fig. 7 [1]								
V _{CC} = 4.5 V	-	22	39	-	49	-	59	ns		
V _{CC} = 5 V; C _L = 15 pF	-	19	-	-	-	-	-	ns		
t _{en}	enable time	OE to QPn; see Fig. 8 [1]								
		V _{CC} = 4.5 V	-	20	35	-	44	-	53	ns
t _{dis}	disable time	OE to QPn; see Fig. 8 [1]								
		V _{CC} = 4.5 V	-	21	35	-	44	-	53	ns
t _t	transition time	QPn and QSn; see Fig. 6 [1]								
		V _{CC} = 4.5 V	-	7	15	-	19	-	22	ns
t _w	pulse width	CP HIGH or LOW; see Fig. 6								
		V _{CC} = 4.5 V	16	7	-	20	-	24	-	ns
		STR HIGH; see Fig. 7								
V _{CC} = 4.5 V	16	5	-	20	-	24	-	ns		
t _{su}	set-up time	Dn to CP; see Fig. 9								
		V _{CC} = 4.5 V	10	4	-	13	-	15	-	ns
		CP to STR; see Fig. 7								
V _{CC} = 4.5 V	20	9	-	25	-	30	-	ns		
t _h	hold time	Dn to CP; see Fig. 9								
		V _{CC} = 4.5 V	4	0	-	4	-	4	-	ns
		CP to STR; see Fig. 7								
V _{CC} = 4.5 V	0	-4	-	0	-	0	-	ns		
f _{max}	maximum frequency	CP; see Fig. 6								
		V _{CC} = 4.5 V	30	80	-	24	-	20	-	MHz
		V _{CC} = 5 V; C _L = 15 pF	-	86	-	-	-	-	-	MHz
C _{PD}	power dissipation capacitance	C _L = 50 pF; f = 1 MHz; V _I = GND to V _{CC} - 1.5 V [2]	-	92	-	-	-	-	-	pF

[1] t_{pd} is the same as t_{PLH} and t_{PHL}; t_{en} is the same as t_{PZH} and t_{PZL}; t_{dis} is the same as t_{PLZ} and t_{PHZ}; t_t is the same as t_{THL} and t_{TLH}.

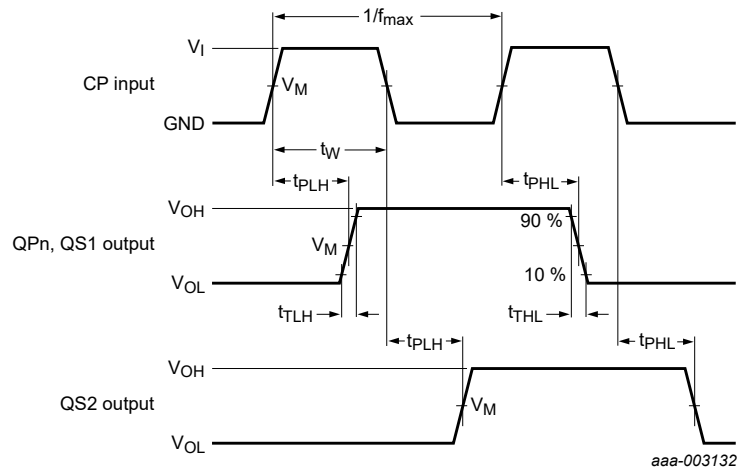
[2] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

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

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.

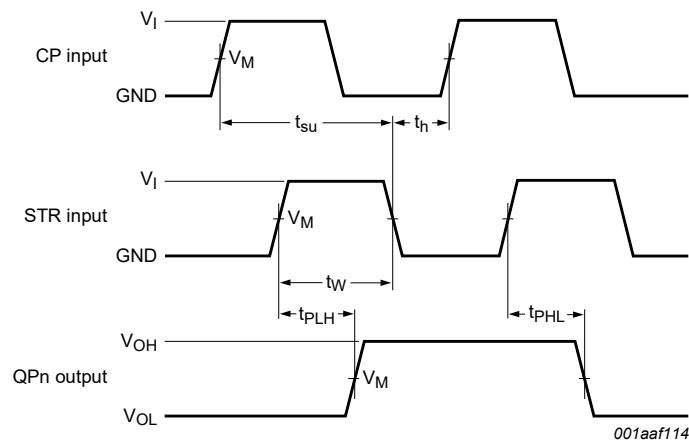
11.1. Waveforms and test circuits



Measurement points are given in [Table 8](#).

V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

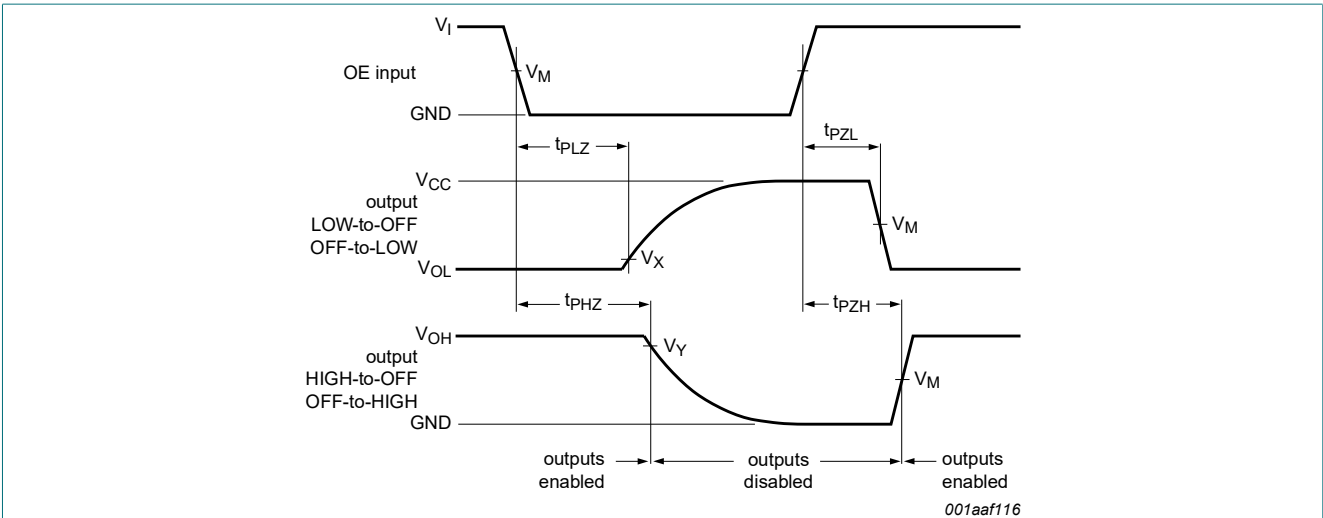
Fig. 6. Propagation delay input (CP) to output (QPn, QS1, QS2), output transition time, clock input (CP) pulse width and the maximum frequency (CP)



Measurement points are given in [Table 8](#).

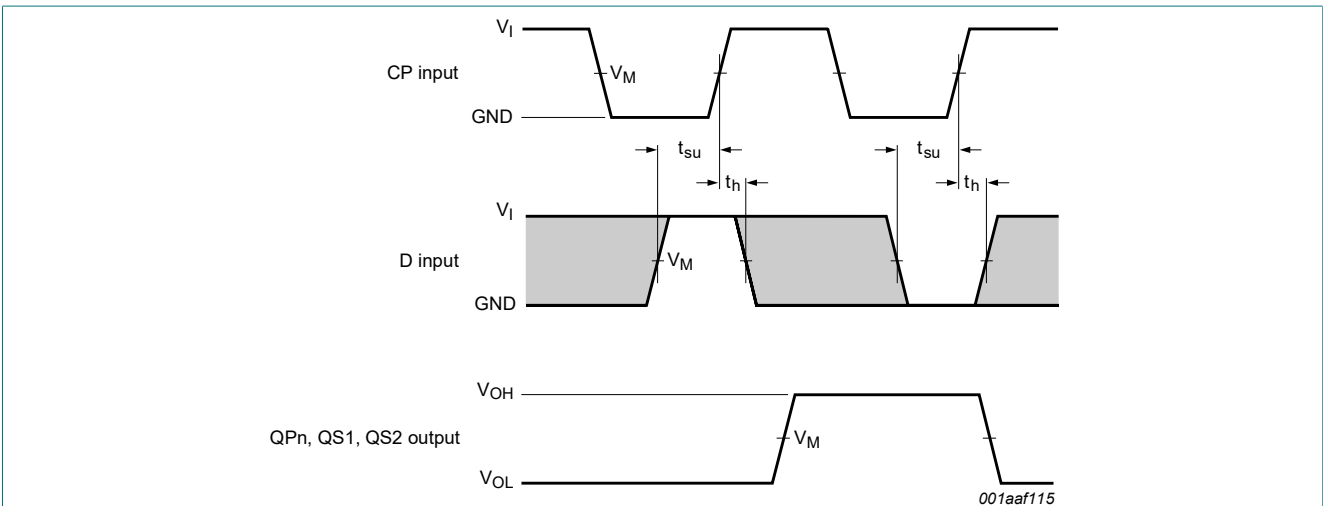
V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

Fig. 7. Propagation delay strobe input (STR) to output (QPn), strobe input (STR) pulse width and the clock set-up and hold times for strobe input



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

Fig. 8. Enable and disable times



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

Fig. 9. The data input (D) to clock input (CP) set-up times and clock input (CP) to data input (D) hold times

Table 8. Measurement points

Type	Input	Output		
	V_M	V_M	V_X	V_Y
74HC4094-Q100	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$0.1 \times V_{OH}$	$0.9 \times V_{OH}$
74HCT4094-Q100	1.3 V	1.3 V	$0.1 \times V_{OH}$	$0.9 \times V_{OH}$

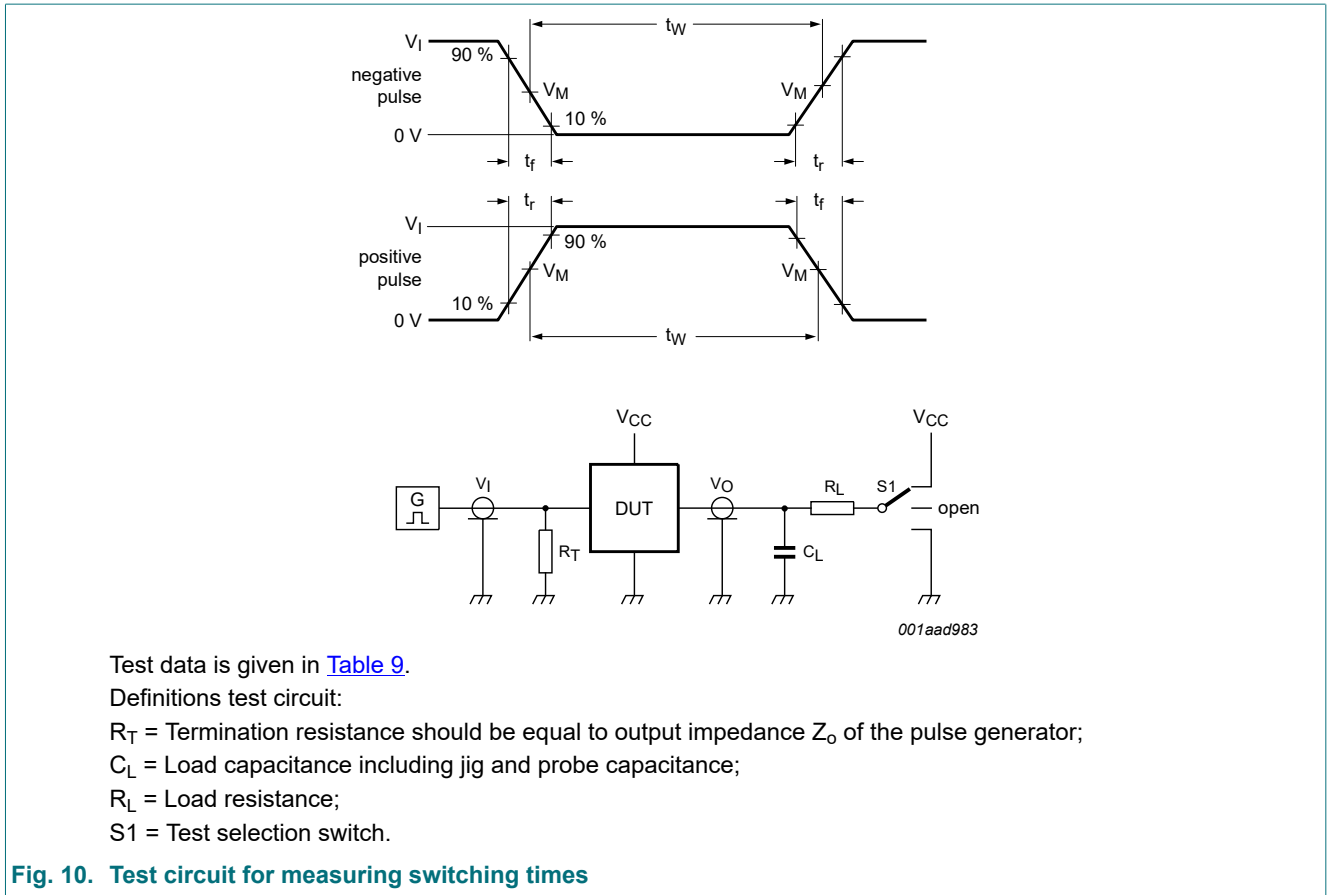


Fig. 10. Test circuit for measuring switching times

Table 9. 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}
74HC4094-Q100	V_{CC}	6 ns	15 pF, 50 pF	1 k Ω	open	GND	V_{CC}
74HCT4094-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

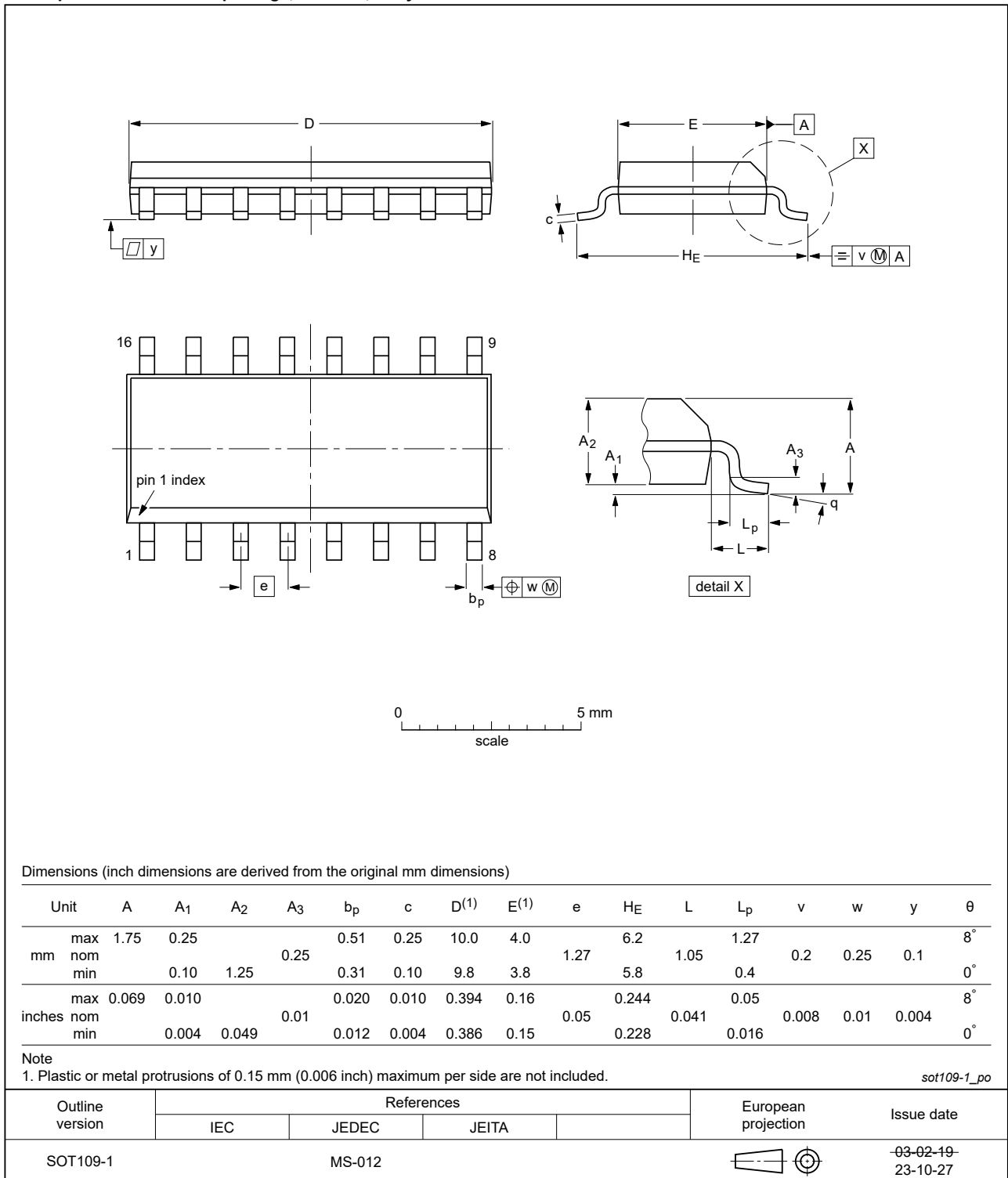


Fig. 11. Package outline SOT109-1 (SO16)

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

SOT403-1

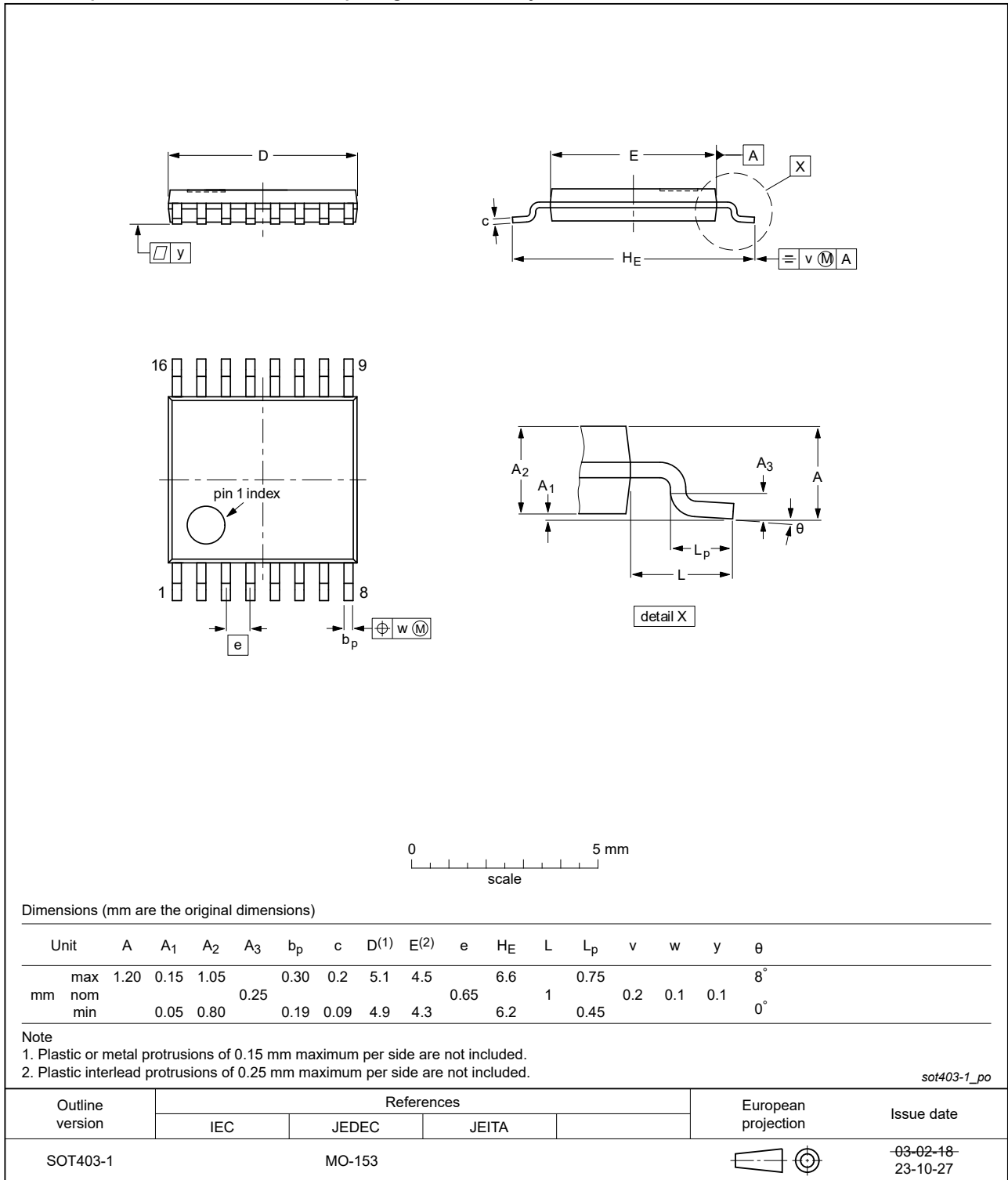


Fig. 12. Package outline SOT403-1 (TSSOP16)

13. Abbreviations

Table 10. Abbreviations

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

14. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT4094_Q100 v.4	20240321	Product data sheet	-	74HC_HCT4094_Q100 v.3
Modifications:	<ul style="list-style-type: none"> • Fig. 11, Fig. 12: Aligned SO and TSSOP package outline drawings to JEDEC MS-012 and MO-153. • Section 2: ESD specification updated according to the latest JEDEC standard. 			
74HC_HCT4094_Q100 v.3	20211022	Product data sheet	-	74HC_HCT4094_Q100 v.2
Modifications:	<ul style="list-style-type: none"> • Type numbers 74HC4094DB-Q100 and 74HCT4094DB-Q100 (SOT338-1/SSOP16) removed. • Section 8: Derating values for P_{tot} total power dissipation updated. 			
74HC_HCT4094_Q100 v.2	20181114	Product data sheet	-	74HC_HCT4094_Q100 v.1
Modifications:	<ul style="list-style-type: none"> • 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. • Fig. 4 and Fig. 5 corrected. 			
74HC_HCT4094_Q100 v.1	20130130	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>.

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