74HC594-Q100; 74HCT594-Q100

8-bit shift register with output register

Rev. 1 — 2 August 2012 | Product data sheet

1. General description

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 ($\overline{SHR}$ and $\overline{STR}$) 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

- 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
- 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 Ω)

3. Applications

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

4. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
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

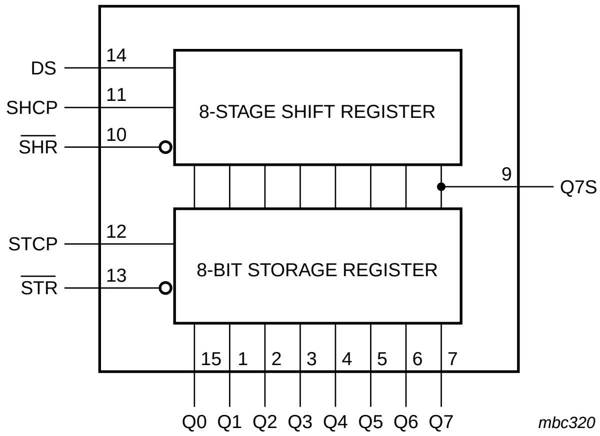


Fig 1. Functional diagram

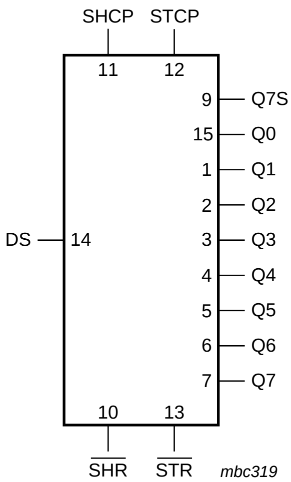


Fig 2. Logic symbol

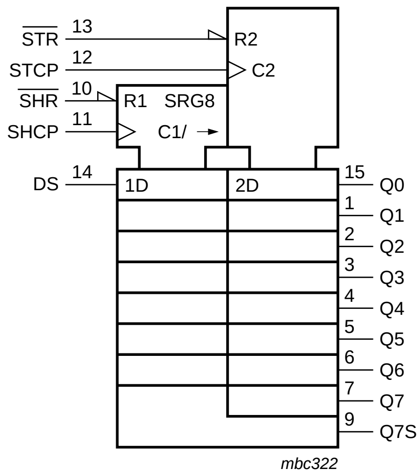


Fig 3. IEC logic symbol

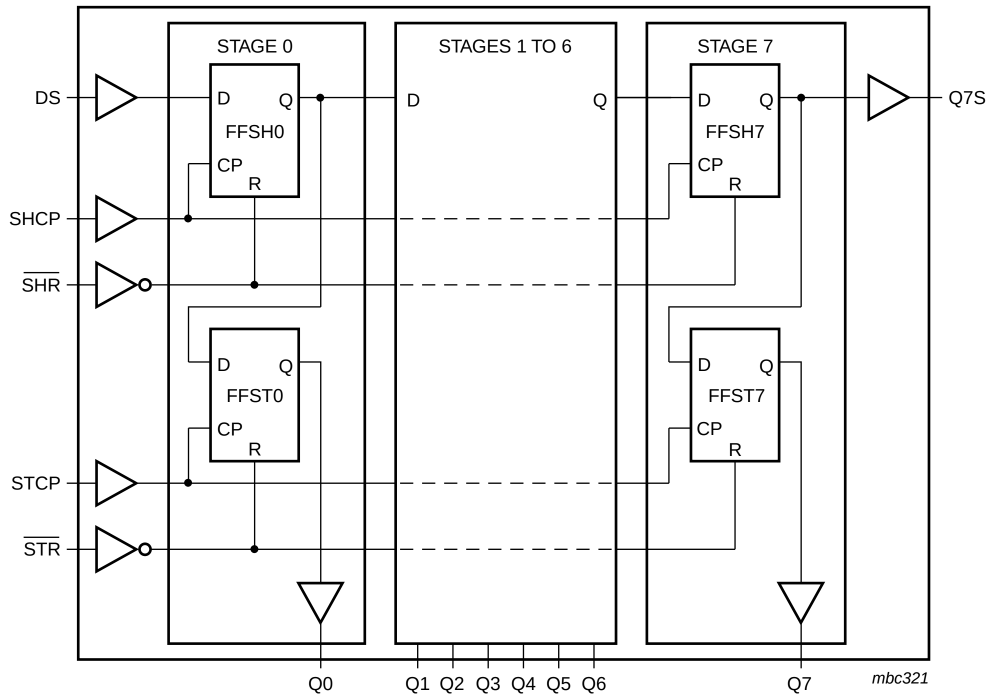


Fig 4. Logic diagram

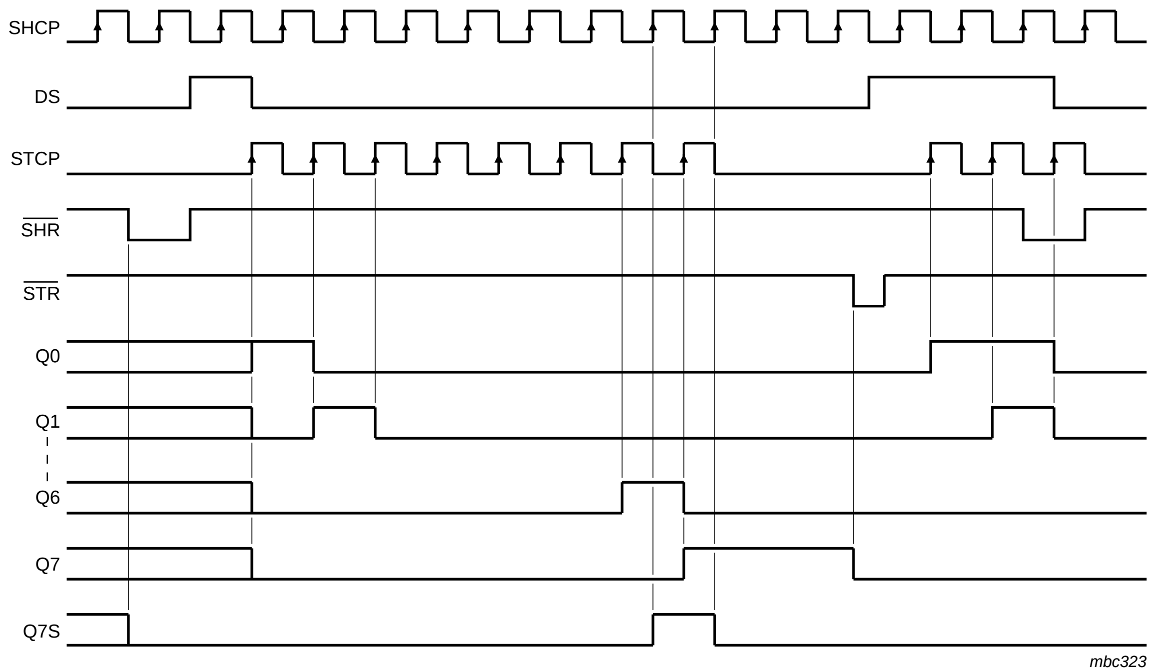


Fig 5. Timing diagram

6. Pinning information

6.1 Pinning

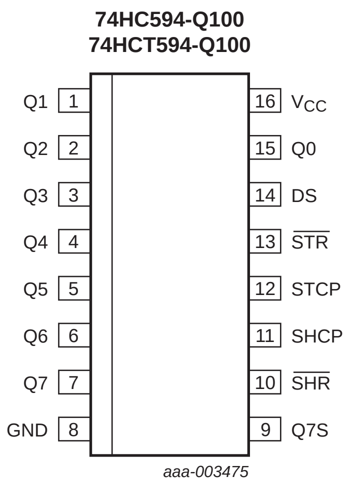


Fig 6. Pin configuration SO16

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
$\overline{SHR}$	10	shift register reset (active LOW)
SHCP	11	shift register clock input
STCP	12	storage register clock input
$\overline{STR}$	13	storage register reset (active LOW)
DS	14	serial data input
V_{CC}	16	supply voltage

7. Functional description

Table 3. Function table[1]

Function	Input				
	$\overline{\text{SHR}}$	$\overline{\text{STR}}$	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	$V_I < -0.5$ 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		-	±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	$T_{amb} = -40$ °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 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
Type 74HC594-Q100						
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 V	-	-	1000	ns
		V_{CC} = 4.5 V	-	6.0	500	ns
		V_{CC} = 6.0 V	-	-	400	ns
t_f	fall time	V_{CC} = 2.0 V	-	-	1000	ns
		V_{CC} = 4.5 V	-	6.0	500	ns
		V_{CC} = 6.0 V	-	-	400	ns
Type 74HCT594-Q100						
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 V	-	6.0	500	ns
t_f	fall time	V_{CC} = 4.5 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
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}				
		Serial data output Q7S				
		I_O = –4.0 mA; V_{CC} = 4.5 V	3.98	4.32	-	V
		I_O = –5.2 mA; V_{CC} = 6.0 V	5.48	5.81	-	V
		Parallel data outputs				
		I_O = –6.0 mA; V_{CC} = 4.5 V	3.98	4.32	-	V
		I_O = –7.8 mA; V_{CC} = 6.0 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_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		Serial data output Q7S				
		I_O = 4.0 mA; V_{CC} = 4.5 V	-	0.15	0.26	V
		I_O = 5.2 mA; V_{CC} = 6.0 V	-	0.16	0.26	V
		Parallel data outputs				
		I_O = 6.0 mA; V_{CC} = 4.5 V	-	0.15	0.26	V
		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}				
		Serial data output Q7S				
		I_O = −4.0 mA; V_{CC} = 4.5 V	3.84	-	-	V
		I_O = −5.2 mA; V_{CC} = 6.0 V	5.34	-	-	V
		Parallel data outputs				
		I_O = −6.0 mA; V_{CC} = 4.5 V	3.84	-	-	V
		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}				
		Serial data output Q7S				
		I_O = 4.0 mA; V_{CC} = 4.5 V	-	-	0.33	V
		I_O = 5.2 mA; V_{CC} = 6.0 V	-	-	0.33	V
		Parallel data outputs				
		I_O = 6.0 mA; V_{CC} = 4.5 V	-	-	0.33	V
		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

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 °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}				
		Serial data output Q7S				
		I_O = –4.0 mA; V_{CC} = 4.5 V	3.7	-	-	V
		I_O = –5.2 mA; V_{CC} = 6.0 V	5.2	-	-	V
		Parallel data outputs				
		I_O = –6.0 mA; V_{CC} = 4.5 V	3.7	-	-	V
		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}				
		Serial data output Q7S				
		I_O = 4.0 mA; V_{CC} = 4.5 V	-	-	0.4	V
		I_O = 5.2 mA; V_{CC} = 6.0 V	-	-	0.4	V
		Parallel data outputs				
		I_O = 6.0 mA; V_{CC} = 4.5 V	-	-	0.4	V
		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}				
		Serial data output Q7S				
		I_O = −4.0 mA; V_{CC} = 4.5 V	3.98	4.32	-	V
		Parallel data outputs				
		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}				
		Serial data output Q7S				
		I_O = 4.0 mA; V_{CC} = 4.5 V	-	0.15	0.26	V
		Parallel data outputs				
		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 $\overline{SHR}$, SHCP, STCP, $\overline{STR}$	-	150	540	µA
		pin DS	-	25	90	µA
C_i	input capacitance		-	3.5	-	pF
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}				
		Serial data output Q7S				
		I_O = −4.0 mA; V_{CC} = 4.5 V	3.84	-	-	V
		Parallel data outputs				
		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}				
		Serial data output				
		I_O = 4.0 mA; V_{CC} = 4.5 V	-	-	0.33	V
		Parallel data outputs				
		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

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
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 $\overline{SHR}$, SHCP, STCP, $\overline{STR}$	-	-	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}				
		Serial data output Q7S				
		$I_O = -4.0$ mA; $V_{CC} = 4.5$ V	3.7	-	-	V
		Parallel data outputs				
		$I_O = -6.0$ mA; $V_{CC} = 4.5$ V	3.7	-	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		Serial data output Q7S				
		$I_O = 4.0$ mA; $V_{CC} = 4.5$ V	-	-	0.4	V
		Parallel data outputs				
		$I_O = 6.0$ 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 $\overline{SHR}$, SHCP, STCP, $\overline{STR}$	-	-	735	μA
		pin DS	-	-	122.5	μA

11. Dynamic characteristics

Table 8. Dynamic characteristics type 74HC594-Q100

GND = 0 V; t_r = t_f = 6 ns; C_L = 50 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 Figure 7 [1]								
		V_{CC} = 2.0 V	-	44	150	-	185	-	225	ns
		V_{CC} = 4.5 V	-	16	30	-	37	-	45	ns
		V_{CC} = 5.0 V; C_L = 15 pF	-	13	-	-	-	-	-	ns
		V_{CC} = 6.0 V	-	14	26	-	31	-	38	ns
		STCP to Qn; see Figure 8								
		V_{CC} = 2.0 V	-	44	150	-	185	-	225	ns
		V_{CC} = 4.5 V	-	16	30	-	37	-	45	ns
		V_{CC} = 5.0 V; C_L = 15 pF	-	13	-	-	-	-	-	ns
		V_{CC} = 6.0 V	-	14	26	-	31	-	38	ns
t_{PHL}	HIGH to LOW propagation delay	$\overline{SHR}$ to Q7S; see Figure 11								
		V_{CC} = 2.0 V	-	39	150	-	185	-	225	ns
		V_{CC} = 4.5 V	-	14	30	-	37	-	45	ns
		V_{CC} = 5.0 V; C_L = 15 pF	-	11	-	-	-	-	-	ns
		V_{CC} = 6.0 V	-	12	26	-	31	-	38	ns
		$\overline{STR}$ to Qn; see Figure 12								
		V_{CC} = 2.0 V	-	39	125	-	155	-	185	ns
		V_{CC} = 4.5 V	-	14	25	-	31	-	37	ns
		V_{CC} = 5.0 V; C_L = 15 pF	-	11	-	-	-	-	-	ns
		V_{CC} = 6.0 V	-	12	21	-	26	-	31	ns
t_{THL}	HIGH to LOW output transition time	see Figure 7								
		Serial data output Q7S								
		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
		Parallel data outputs								
		V_{CC} = 2.0 V	-	14	60	-	75	-	90	ns
		V_{CC} = 4.5 V	-	5	12	-	15	-	18	ns
		V_{CC} = 6.0 V	-	4	10	-	13	-	15	ns

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

GND = 0 V; t_r = t_f = 6 ns; C_L = 50 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 Figure 7								
		Serial data output Q7S								
		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
		Parallel data outputs								
		V_{CC} = 2.0 V	-	14	60	-	75	-	90	ns
		V_{CC} = 4.5 V	-	5	12	-	15	-	18	ns
		V_{CC} = 6.0 V	-	4	10	-	13	-	15	ns
t_W	pulse width	SHCP (HIGH or LOW); see Figure 7								
		V_{CC} = 2.0 V	80	10	-	100	-	120	-	ns
		V_{CC} = 4.5 V	16	4	-	20	-	24	-	ns
		V_{CC} = 6.0 V	14	3	-	17	-	20	-	ns
		STCP (HIGH or LOW); see Figure 8								
		V_{CC} = 2.0 V	80	10	-	100	-	120	-	ns
		V_{CC} = 4.5 V	16	4	-	20	-	24	-	ns
		V_{CC} = 6.0 V	14	3	-	17	-	20	-	ns
		$\overline{SHR}$ and $\overline{STR}$ (HIGH or LOW); see Figure 11 and Figure 12								
		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

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

GND = 0 V; t_r = t_f = 6 ns; C_L = 50 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 Figure 9								
		V_{CC} = 2.0 V	100	10	-	125	-	150	-	ns
		V_{CC} = 4.5 V	20	4	-	25	-	30	-	ns
		V_{CC} = 6.0 V	17	3	-	21	-	26	-	ns
		$\overline{SHR}$ to STCP; see Figure 10								
		V_{CC} = 2.0 V	100	14	-	125	-	150	-	ns
		V_{CC} = 4.5 V	20	5	-	25	-	30	-	ns
		V_{CC} = 6.0 V	17	4	-	21	-	26	-	ns
		SHCP to STCP; see Figure 8								
		V_{CC} = 2.0 V	100	17	-	125	-	150	-	ns
		V_{CC} = 4.5 V	20	6	-	25	-	30	-	ns
		V_{CC} = 6.0 V	17	5	-	21	-	26	-	ns
t_h	hold time	DS to SHCP; see Figure 9								
		V_{CC} = 2.0 V	25	−8	-	30	-	35	-	ns
		V_{CC} = 4.5 V	5	−3	-	6	-	7	-	ns
		V_{CC} = 6.0 V	4	−2	-	5	-	6	-	ns
t_{rec}	recovery time	$\overline{SHR}$ to SHCP and $\overline{STR}$ to STCP; see Figure 11 and Figure 12								
		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
f_{max}	maximum frequency	SHCP or STCP; see Figure 7 and Figure 8								
		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

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

GND = 0 V; t_r = t_f = 6 ns; C_L = 50 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}; V_{CC} = 5 V; f_i = 1 MHz [2]	-	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):

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

$\Sigma(C_L \times V_{CC}^2 \times f_o)$ = 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; 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 Figure 7 [1]	-	18	32	-	40	-	48	ns
		V_{CC} = 5.0 V; C_L = 15 pF	-	15	-	-	-	-	-	ns
		STCP to Qn; see Figure 8	-	18	32	-	40	-	48	ns
		V_{CC} = 5.0 V; C_L = 15 pF	-	15	-	-	-	-	-	ns
t_{PHL}	HIGH to LOW propagation delay	$\overline{SHR}$ to Q7S; see Figure 11	-	17	30	-	38	-	45	ns
		V_{CC} = 5.0 V; C_L = 15 pF	-	14	-	-	-	-	-	ns
		$\overline{STR}$ to Qn; see Figure 12	-	17	30	-	38	-	45	ns
		V_{CC} = 5.0 V; C_L = 15 pF	-	14	-	-	-	-	-	ns
t_{THL}	HIGH to LOW output transition time	see Figure 7								
		Serial data output Q7S								
		V_{CC} = 4.5 V	-	7	15	-	19	-	22	ns
		Parallel data outputs								
		V_{CC} = 4.5 V	-	5	12	-	15	-	18	ns
t_{TLH}	LOW to HIGH output transition time	see Figure 7								
		Serial data output Q7S								
		V_{CC} = 4.5 V	-	7	15	-	19	-	22	ns
		Parallel data outputs								
		V_{CC} = 4.5 V	-	5	12	-	15	-	18	ns

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

GND = 0 V; V_{CC} = 4.5 V; $t_r = t_f$ = 6 ns; C_L = 50 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 Figure 7	16	4	-	20	-	24	-	ns
		STCP (HIGH or LOW); see Figure 8	16	4	-	20	-	24	-	ns
		$\overline{\text{SHR}}$ and $\overline{\text{STR}}$ (HIGH or LOW); see Figure 11 and Figure 12	16	6	-	20	-	24	-	ns
t_{su}	set-up time	DS to SHCP; see Figure 9	20	4	-	25	-	30	-	ns
		$\overline{\text{SHR}}$ to STCP; see Figure 10	20	6	-	25	-	30	-	ns
		SHCP to STCP; see Figure 8	20	7	-	25	-	30	-	ns
t_h	hold time	DS to SHCP; see Figure 9	5	−3	-	6	-	7	-	ns
t_{rec}	recovery time	$\overline{\text{SHR}}$ to SHCP and $\overline{\text{STR}}$ to STCP; see Figure 11 and Figure 12	10	−5	-	13	-	15	-	ns
f_{max}	maximum frequency	SHCP or STCP; see Figure 7 and Figure 8	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):

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

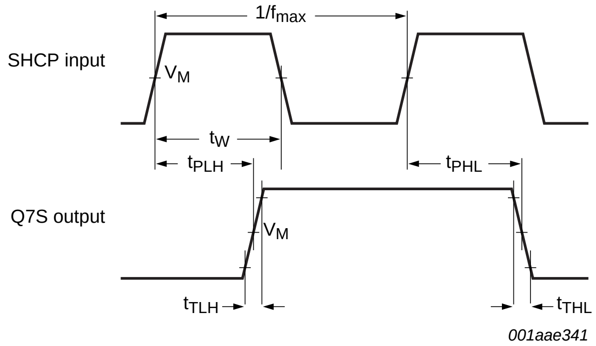
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

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

12. Waveforms

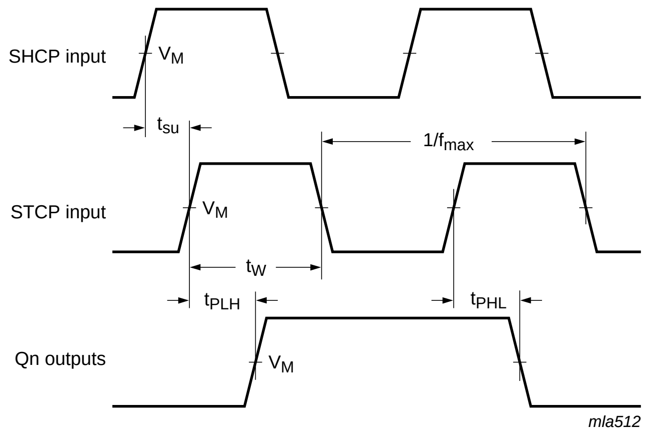


Measurement points are given in Table 10.

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.

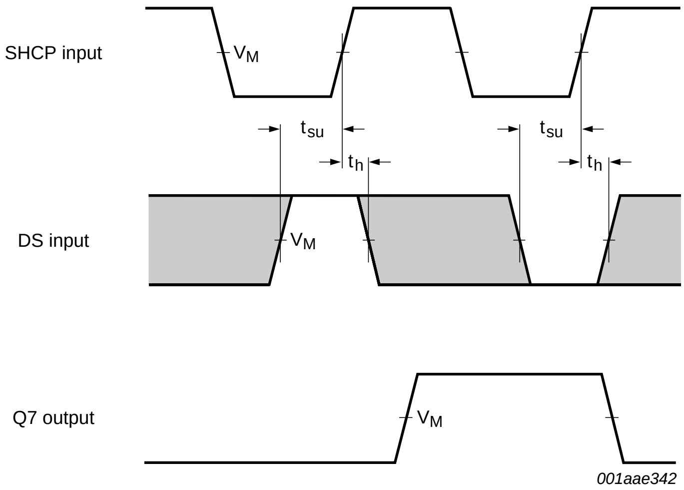
Fig 7. The shift clock (SHCP) to output (Q7S) propagation delays, the shift clock pulse width, the maximum shift clock frequency, and output transition times



Measurement points are given in Table 10.

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

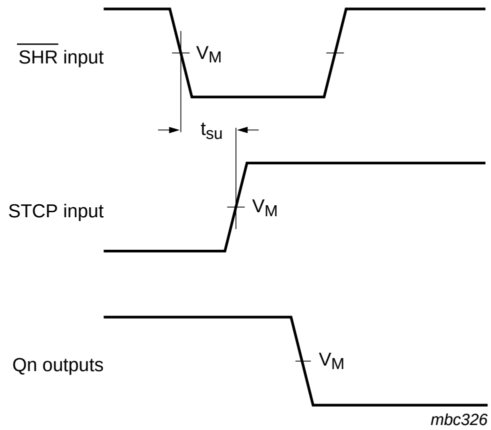
Fig 8. The storage clock (STCP) to output (Qn), propagation delays, the storage clock pulse width, the maximum storage clock pulse frequency and the shift clock to storage clock set-up time



Measurement points are given in Table 10.

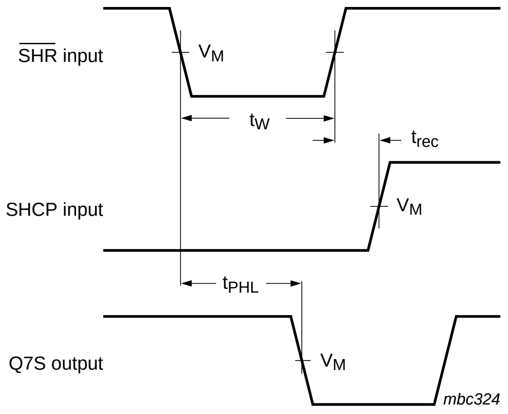
The shaded areas indicate when the input is permitted to change for predictable output performance.

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



Measurement points are given in Table 10.

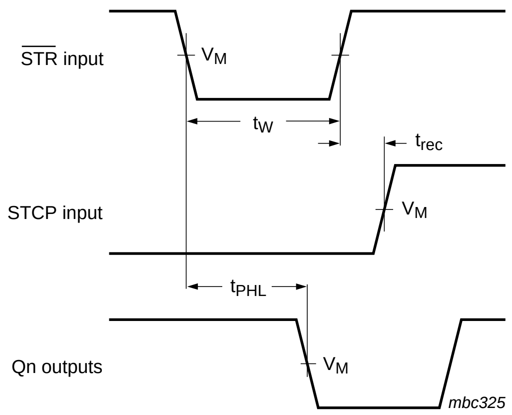
Fig 10. The set-up time shift reset (SHR) to storage clock (STCP)



Measurement points are given in Table 10.

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

Fig 11. The shift reset ($\overline{SHR}$) pulse width, the shift reset to output (Q7S) propagation delay and the shift reset to shift clock (SHCP) recovery time



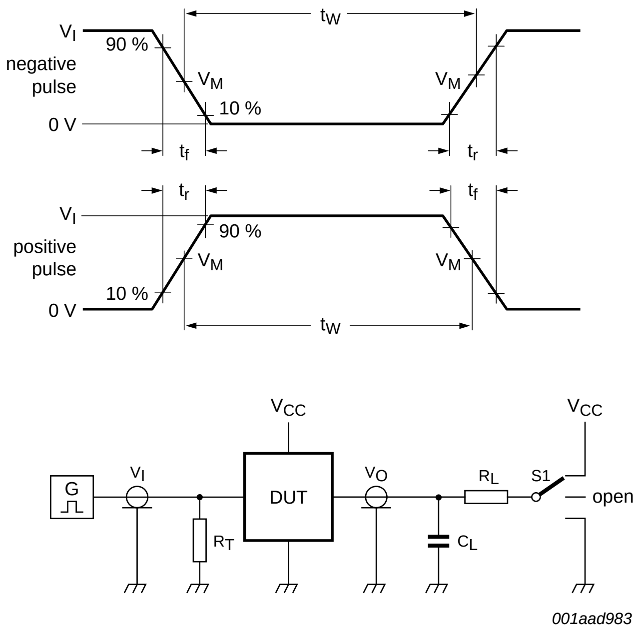
Measurement points are given in Table 10.

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

Fig 12. The storage reset ($\overline{STR}$) 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



Test data is given in Table 11.

Definitions test circuit:

R_T = Termination resistance should be equal to output impedance Z_o of the pulse generator

C_L = Load capacitance including jig and probe capacitance

R_L = Load resistor

S1 = Test selection switch

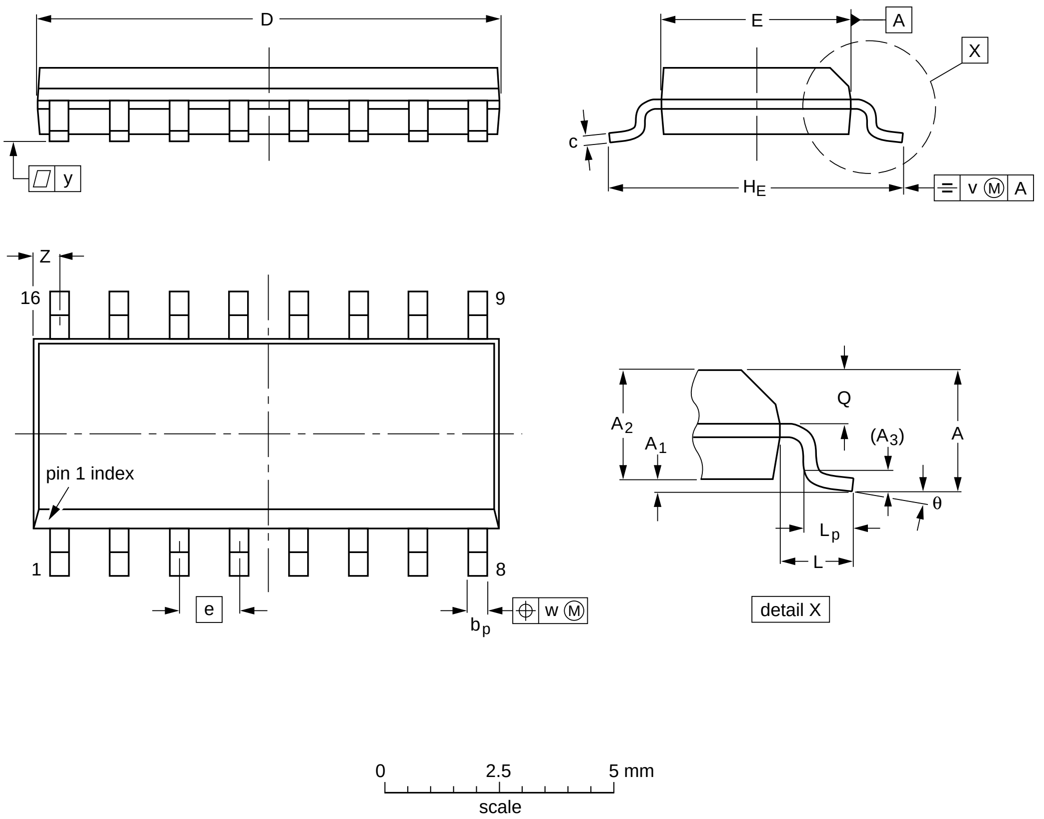
Fig 13. Test circuit for measuring switching times

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

13. Package outline

SO16: plastic small outline package; 16 leads; body width 3.9 mm **SOT109-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (1)	e	H_E	L	L_p	Q	v	w	y	Z (1)	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	10.0 9.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8^o 0^o
inches	0.069	0.010 0.004	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.39 0.38	0.16 0.15	0.05	0.244 0.228	0.041	0.039 0.016	0.028 0.020	0.01	0.01	0.004	0.028 0.012	

Note

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT109-1	076E07	MS-012				~~99-12-27~~ 03-02-19

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[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 URL http://www.nxp.com.

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18. Contents

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