



# 74HC107-Q100; 74HCT107-Q100

Dual JK flip-flop with reset; negative-edge trigger

Rev. 4 — 20 February 2024

Product data sheet

## 1. General description

The 74HC107-Q100; 74HCT107-Q100 is a dual negative edge triggered JK flip-flop featuring individual J and K inputs, clock (CP) and reset (R) inputs and complementary Q and  $\bar{Q}$  outputs. The reset is an asynchronous active LOW input and operates independently of the clock input. The J and K inputs control the state changes of the flip-flops as described in the mode select function table. The J and K inputs must be stable one set-up time prior to the HIGH-to-LOW clock transition for predictable operation. Inputs include clamp diodes that enable 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

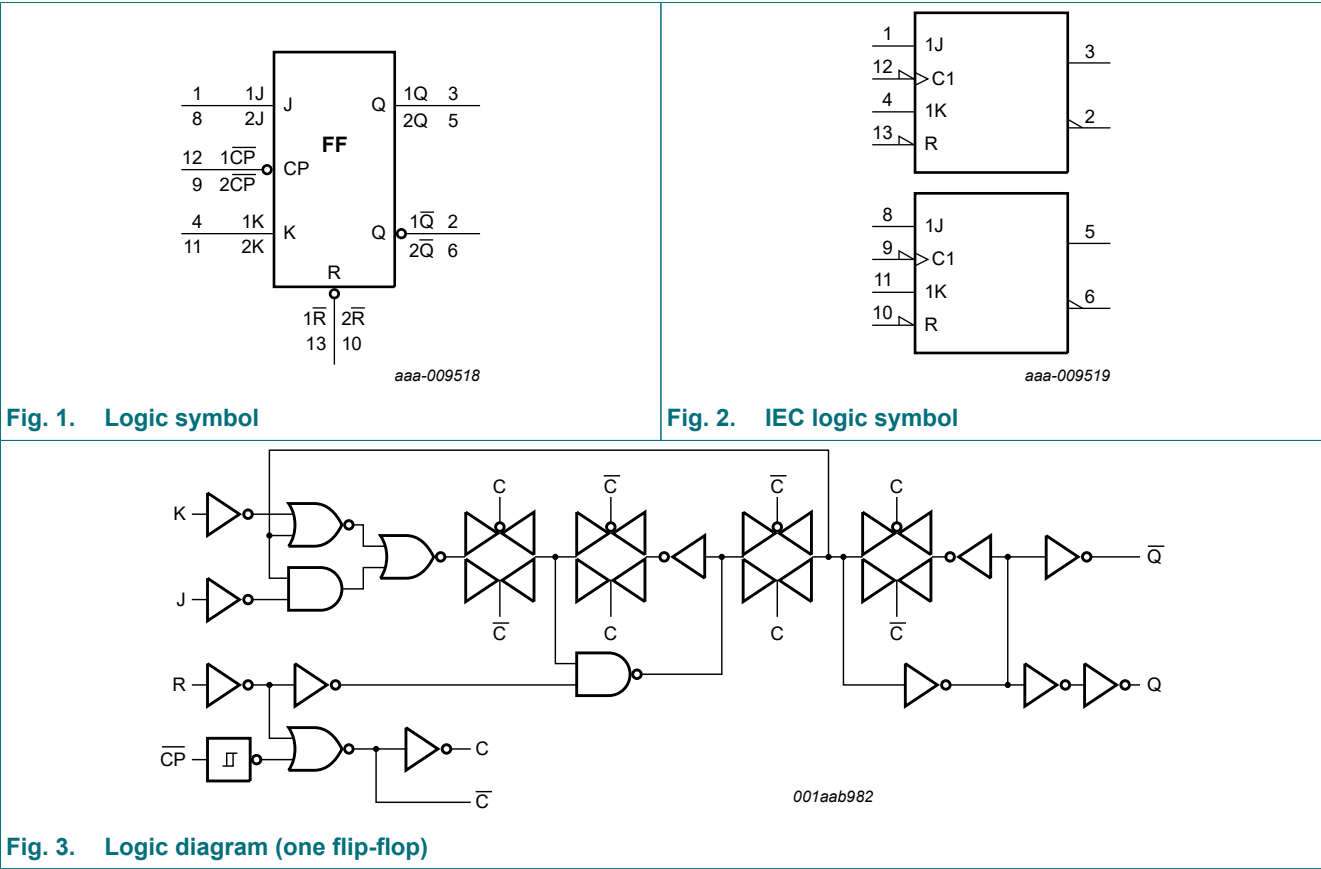
- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- Wide supply voltage range from 2.0 V to 6.0 V
- CMOS low power dissipation
- High noise immunity
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Complies with JEDEC standards:
  - JESD8C (2.7 V to 3.6 V)
  - JESD7A (2.0 V to 6.0 V)
- Input levels:
  - For 74HC107-Q100: CMOS level
  - For 74HCT107-Q100: TTL level
- 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. Ordering information

Table 1. Ordering information

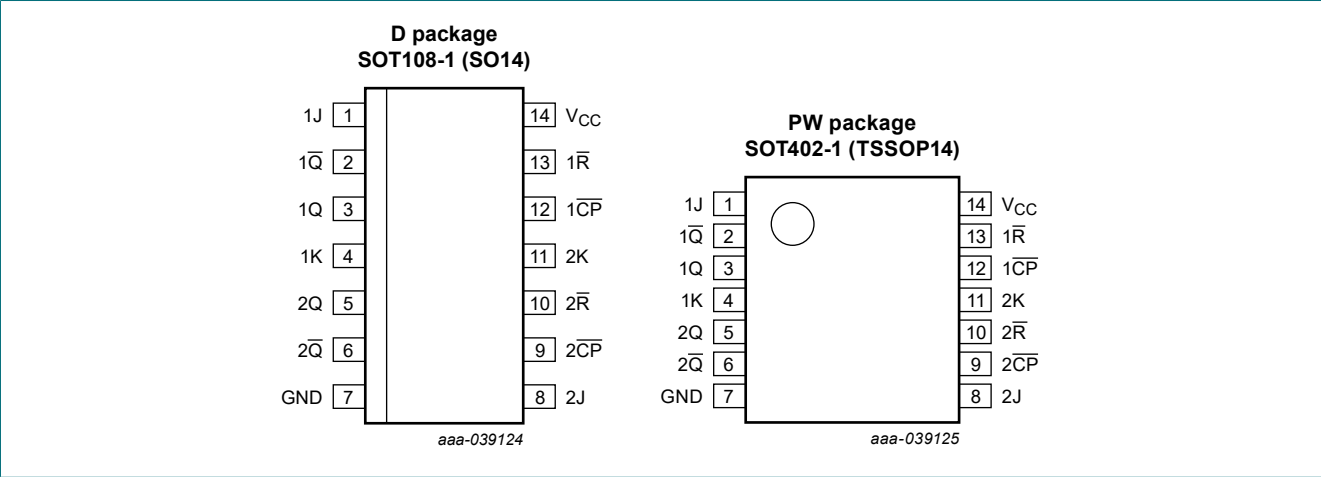
Type number	Package			
	Temperature range	Name	Description	Version
<a href="#">74HC107D-Q100</a> <a href="#">74HCT107D-Q100</a>	-40 °C to +125 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	<a href="#">SOT108-1</a>
<a href="#">74HC107PW-Q100</a>	-40 °C to +125 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	<a href="#">SOT402-1</a>

4. Functional diagram



5. Pinning information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
1J, 2J	1, 8	synchronous J input
1Q, 2Q	2, 6	complement output
1Q, 2Q	3, 5	true output
1K, 2K	4, 11	synchronous K input
1CP, 2CP	12, 9	clock input (HIGH-to-LOW edge-triggered)
1R, 2R	13, 10	asynchronous reset input (active LOW)
GND	7	ground (0 V)
V <sub>CC</sub>	14	supply voltage

6. Functional description

Table 3. Function table

*H = HIGH voltage level; h = HIGH voltage level one set-up time prior to the HIGH-to-LOW clock transition;  
L = LOW voltage level; l = LOW voltage level one set-up time prior to the HIGH-to-LOW clock transition;  
q = state of referenced output one set-up time prior to the HIGH-to-LOW clock transition; X = don't care;  
↓ = HIGH-to-LOW clock transition.*

Input				Output		Operating mode
R	CP	J	K	Q	Q	
L	X	X	X	L	H	asynchronous reset
H	↓	h	h	q	q	toggle
H	↓	l	h	L	H	load 0 (reset)
H	↓	h	l	H	L	load 1 (set)
H	↓	l	l	q	q	hold (no change)

7. 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 <sub>CC</sub>	supply voltage		-0.5	+7.0	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < -0.5 V or V <sub>I</sub> > V <sub>CC</sub> + 0.5 V [1]	-	±20	mA
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < -0.5 V or V <sub>O</sub> > V <sub>CC</sub> + 0.5 V [1]	-	±20	mA
I <sub>O</sub>	output current	V <sub>O</sub> = -0.5 V to V <sub>CC</sub> + 0.5 V	-	±25	mA
I <sub>CC</sub>	supply current		-	50	mA
I <sub>GND</sub>	ground current		-50	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -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 SOT108-1 (SO14) package: P<sub>tot</sub> derates linearly with 10.1 mW/K above 100 °C.  
For SOT402-1 (TSSOP14) package: P<sub>tot</sub> derates linearly with 7.3 mW/K above 81 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V)

Symbol	Parameter	Conditions	74HC107-Q100			74HCT107-Q100			Unit
			Min	Typ	Max	Min	Typ	Max	
V <sub>CC</sub>	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
V <sub>I</sub>	input voltage		0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V
V <sub>O</sub>	output voltage		0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V
T <sub>amb</sub>	ambient temperature		-40	+25	+125	-40	+25	+125	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 2.0 V	-	-	625	-	-	-	ns/V
		V <sub>CC</sub> = 4.5 V	-	1.67	139	-	1.67	139	ns/V
		V <sub>CC</sub> = 6.0 V	-	-	83	-	-	-	ns/V

9. 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	
74HC107-Q100										
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 2.0 V	1.5	1.2	-	1.5	-	1.5	-	V
		V <sub>CC</sub> = 4.5 V	3.15	2.4	-	3.15	-	3.15	-	V
		V <sub>CC</sub> = 6.0 V	4.2	3.2	-	4.2	-	4.2	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 2.0 V	-	0.8	0.5	-	0.5	-	0.5	V
		V <sub>CC</sub> = 4.5 V	-	2.1	1.35	-	1.35	-	1.35	V
		V <sub>CC</sub> = 6.0 V	-	2.8	1.8	-	1.8	-	1.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
		I <sub>O</sub> = -20 µA; V <sub>CC</sub> = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I <sub>O</sub> = -20 µA; V <sub>CC</sub> = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -20 µA; V <sub>CC</sub> = 6.0 V	5.9	6.0	-	5.9	-	5.9	-	V
		I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V	3.98	4.32	-	3.84	-	3.7	-	V
		I <sub>O</sub> = -5.2 mA; V <sub>CC</sub> = 6.0 V	5.48	5.81	-	5.34	-	5.2	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
		I <sub>O</sub> = 20 µA; V <sub>CC</sub> = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 20 µA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 20 µA; V <sub>CC</sub> = 6.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.26	-	0.33	-	0.4	V
		I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V	-	0.16	0.26	-	0.33	-	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	-	-	±0.1	-	±1.0	-	±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	-	-	4.0	-	40	-	80	µA
C <sub>I</sub>	input capacitance		-	3.5	-					pF
74HCT107-Q100										
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	1.6	-	2.0	-	2.0	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	-	1.2	0.8	-	0.8	-	0.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V								
		I <sub>O</sub> = -20 µA	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -4 mA	3.98	4.32	-	3.84	-	3.7	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V								
		I <sub>O</sub> = 20 µA	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 4.0 mA	-	0.16	0.26	-	0.33	-	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	-	-	±0.1	-	±1.0	-	±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	-	-	4.0	-	40	-	80	µA

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
$\Delta I_{CC}$	additional supply current	per input pin; $V_I = V_{CC} - 2.1\text{ V}$ ; $I_O = 0\text{ A}$ ; other inputs at $V_{CC}$ or GND; $V_{CC} = 4.5\text{ V}$ to $5.5\text{ V}$								
		pin $\overline{nCP}$ , nJ	-	100	360	-	450	-	490	$\mu\text{A}$
		pin $\overline{nR}$	-	65	234	-	293	-	319	$\mu\text{A}$
		pin nK	-	60	216	-	270	-	294	$\mu\text{A}$
$C_I$	input capacitance		-	3.5	-	-	-	-	-	pF

10. Dynamic characteristics

Table 7. Dynamic characteristics

GND (ground = 0 V);  $C_L = 50\text{ pF}$  unless otherwise specified; for test circuit, see Fig. 6

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HC107-Q100										
t <sub>pd</sub>	propagation delay	nCP to nQ; see Fig. 4 [1]								
		V <sub>CC</sub> = 2.0 V	-	52	160	-	200	-	240	ns
		V <sub>CC</sub> = 4.5 V	-	19	32	-	40	-	48	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	16	-	-	-	-	-	ns
		V <sub>CC</sub> = 6.0 V	-	15	27	-	34	-	41	ns
		nCP to nQ̄; see Fig. 4								
		V <sub>CC</sub> = 2.0 V	-	52	160	-	200	-	240	ns
		V <sub>CC</sub> = 4.5 V	-	19	32	-	40	-	48	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	16	-	-	-	-	-	ns
		V <sub>CC</sub> = 6.0 V	-	15	27	-	34	-	41	ns
		nR̄ to nQ, nQ̄; see Fig. 5								
		V <sub>CC</sub> = 2.0 V	-	52	155	-	195	-	235	ns
		V <sub>CC</sub> = 4.5 V	-	19	31	-	39	-	47	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	16	-	-	-	-	-	ns
		V <sub>CC</sub> = 6.0 V	-	15	26	-	33	-	40	ns
t <sub>t</sub>	transition time	nQ, nQ̄; see Fig. 4 [2]								
		V <sub>CC</sub> = 2.0 V	-	19	75	-	95	-	110	ns
		V <sub>CC</sub> = 4.5 V	-	7	15	-	19	-	22	ns
		V <sub>CC</sub> = 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 <sub>W</sub>	pulse width	nCP̄ input, HIGH or LOW; see Fig. 4								
		V <sub>CC</sub> = 2.0 V	80	22	-	100	-	120	-	ns
		V <sub>CC</sub> = 4.5 V	16	8	-	20	-	24	-	ns
		V <sub>CC</sub> = 6.0 V	14	6	-	17	-	20	-	ns
		nR̄ input, HIGH or LOW; see Fig. 5								
		V <sub>CC</sub> = 2.0 V	80	22	-	100	-	120	-	ns
		V <sub>CC</sub> = 4.5 V	16	8	-	20	-	24	-	ns
		V <sub>CC</sub> = 6.0 V	14	6	-	17	-	20	-	ns
t <sub>rec</sub>	recovery time	nR̄ to nCP̄; see Fig. 5								
		V <sub>CC</sub> = 2.0 V	60	19	-	75	-	90	-	ns
		V <sub>CC</sub> = 4.5 V	12	7	-	15	-	18	-	ns
		V <sub>CC</sub> = 6.0 V	20	6	-	13	-	15	-	ns
t <sub>su</sub>	set-up time	nJ, nK to nCP̄; see Fig. 4								
		V <sub>CC</sub> = 2.0 V	100	22	-	125	-	150	-	ns
		V <sub>CC</sub> = 4.5 V	20	8	-	25	-	30	-	ns
		V <sub>CC</sub> = 6.0 V	17	6	-	21	-	26	-	ns
t <sub>h</sub>	hold time	nJ, nK to nCP̄; see Fig. 4								
		V <sub>CC</sub> = 2.0 V	3	-6	-	3	-	3	-	ns
		V <sub>CC</sub> = 4.5 V	3	-2	-	3	-	3	-	ns
		V <sub>CC</sub> = 6.0 V	3	-2	-	3	-	3	-	ns
f <sub>max</sub>	maximum frequency	nCP̄ input; see Fig. 4								
		V <sub>CC</sub> = 2.0 V	6	23	-	4.8	-	4.0	-	MHz
		V <sub>CC</sub> = 4.5 V	30	70	-	24	-	20	-	MHz
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	78	-	-	-	-	-	MHz
		V <sub>CC</sub> = 6.0 V	35	85	-	28	-	24	-	MHz
C <sub>PD</sub>	power dissipation capacitance	per flip-flop; V <sub>I</sub> = GND to V <sub>CC</sub> [3]	-	30	-	-	-	-	-	pF
74HCT107-Q100										
t <sub>pd</sub>	propagation delay	nCP̄ to nQ; see Fig. 4 [1]								
		V <sub>CC</sub> = 4.5 V	-	19	36	-	45	-	54	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	16	-	-	-	-	-	ns
		nCP̄ to nQ̄; see Fig. 4								
		V <sub>CC</sub> = 4.5 V	-	21	36	-	45	-	54	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	18	-	-	-	-	-	ns
		nR̄ to nQ, nQ̄; see Fig. 5								
		V <sub>CC</sub> = 4.5 V	-	20	38	-	48	-	57	ns
t <sub>t</sub>	transition time	nQ, nQ̄; see Fig. 4 [2]								
		V <sub>CC</sub> = 4.5 V	-	7	15	-	19	-	22	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	n $\overline{\text{CP}}$ input, HIGH or LOW; see Fig. 4								
		V <sub>CC</sub> = 4.5 V	16	9	-	20	-	24	-	ns
		n $\overline{\text{R}}$ input, HIGH or LOW; see Fig. 5								
		V <sub>CC</sub> = 4.5 V	20	11	-	25	-	30	-	ns
t <sub>rec</sub>	recovery time	n $\overline{\text{R}}$ to n $\overline{\text{CP}}$ ; see Fig. 5								
		V <sub>CC</sub> = 4.5 V	14	8	-	18	-	21	-	ns
t <sub>su</sub>	set-up time	nJ, nK to n $\overline{\text{CP}}$ ; see Fig. 4								
		V <sub>CC</sub> = 4.5 V	20	7	-	25	-	30	-	ns
t <sub>h</sub>	hold time	nJ, nK to n $\overline{\text{CP}}$ ; see Fig. 4								
		V <sub>CC</sub> = 4.5 V	5	-2	-	5	-	5	-	ns
f <sub>max</sub>	maximum frequency	n $\overline{\text{CP}}$ input; see Fig. 4								
		V <sub>CC</sub> = 4.5 V	30	66	-	24	-	20	-	MHz
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	73	-	-	-	-	-	MHz
C <sub>PD</sub>	power dissipation capacitance	per flip-flop; V <sub>I</sub> = GND to V <sub>CC</sub> - 1.5 V [3]	-	30	-	-	-	-	-	pF

[1] t<sub>pd</sub> is the same as t<sub>PHL</sub>, t<sub>PLH</sub>.

[2] t<sub>i</sub> is the same as t<sub>THL</sub>, t<sub>TLH</sub>.

[3] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$  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;  
 $\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.



10.1. Waveforms and test circuit

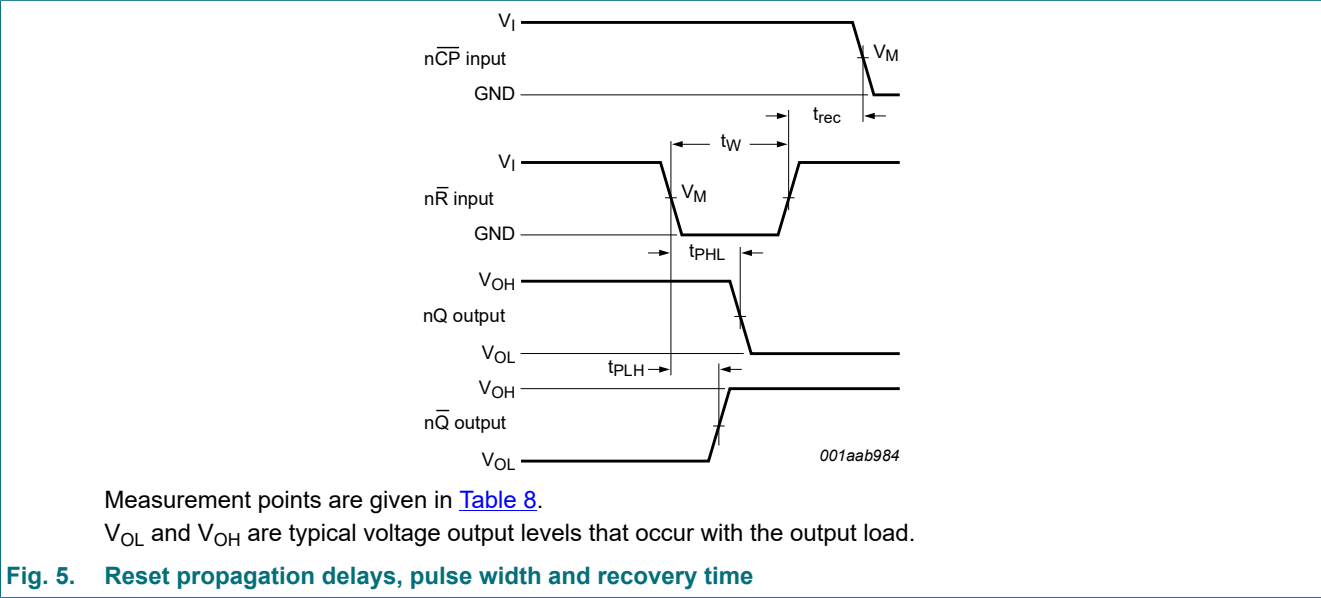
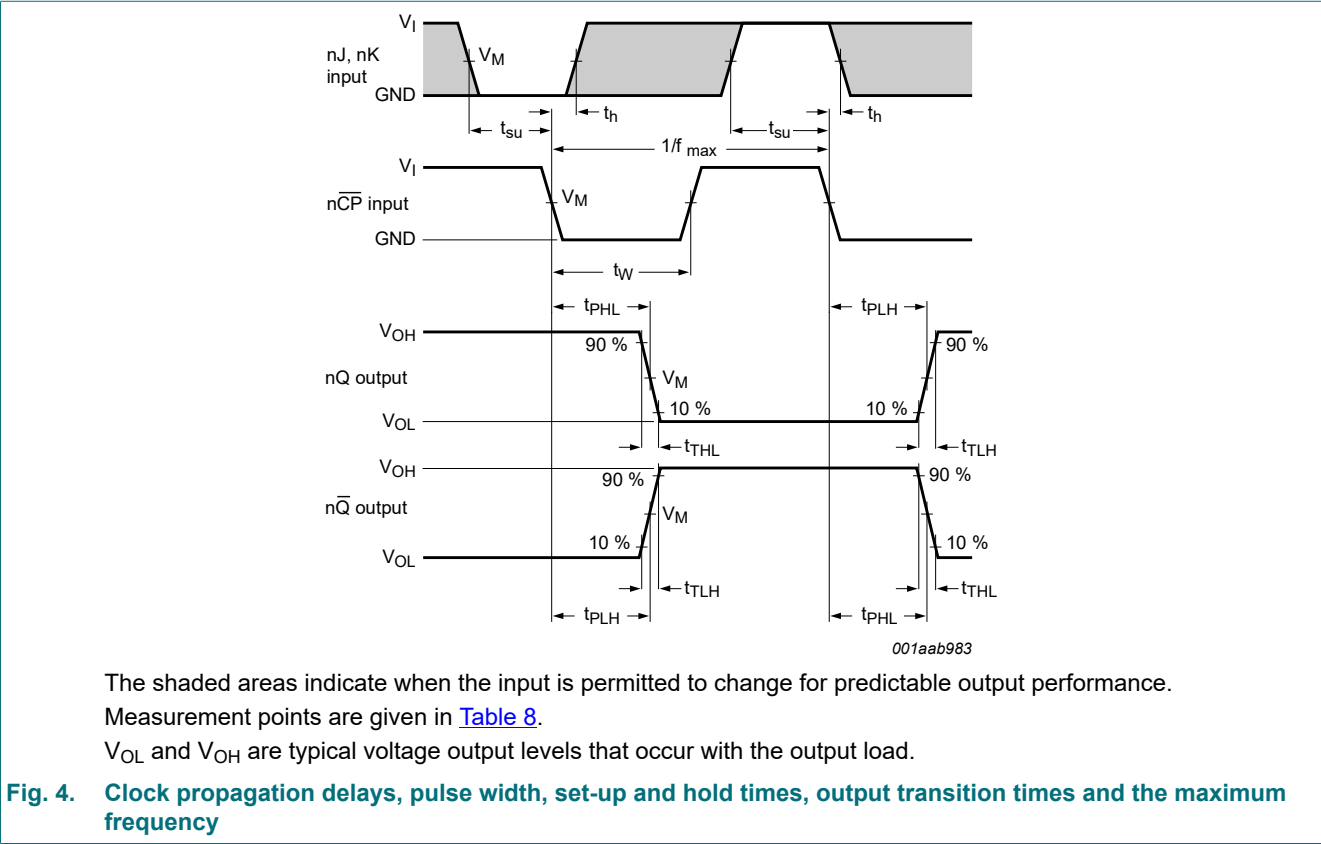
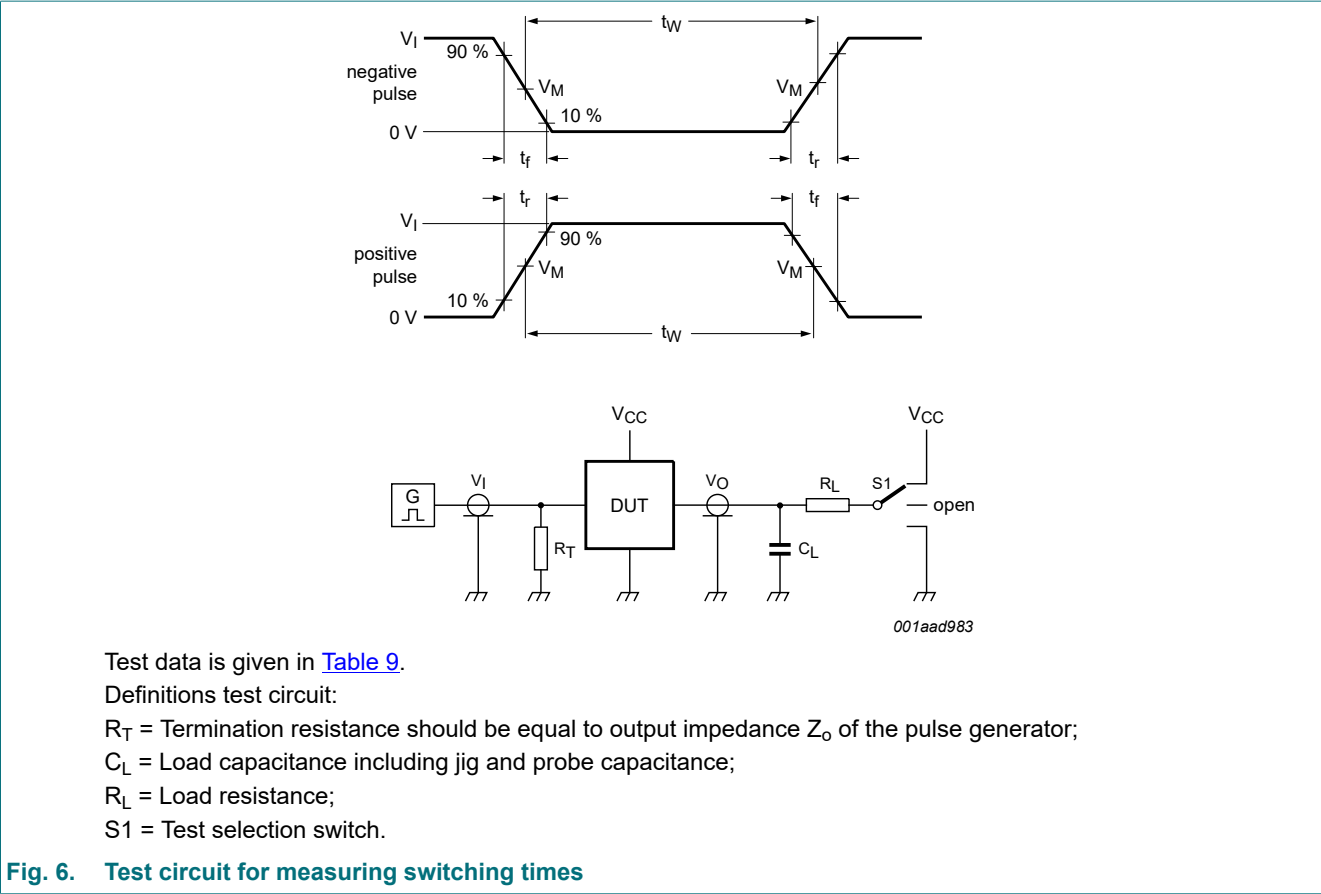


Table 8. Measurement points

Type	Input		Output
	$V_I$	$V_M$	$V_M$
74HC107-Q100	$V_{CC}$	$0.5V_{CC}$	$0.5V_{CC}$
74HCT107-Q100	3 V	1.3 V	1.3 V



Test data is given in [Table 9](#).

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 resistance;

$S1$  = Test selection switch.

**Fig. 6. Test circuit for measuring switching times**

**Table 9. Test data**

Type	Input		Load		S1 position		
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$
74HC107-Q100	$V_{CC}$	6 ns	15 pF, 50 pF	1 kΩ	open	GND	$V_{CC}$
74HCT107-Q100	3 V	6 ns	15 pF, 50 pF	1 kΩ	open	GND	$V_{CC}$

11. Package outline

SO14: plastic small outline package; 14 leads; body width 3.9 mm

SOT108-1

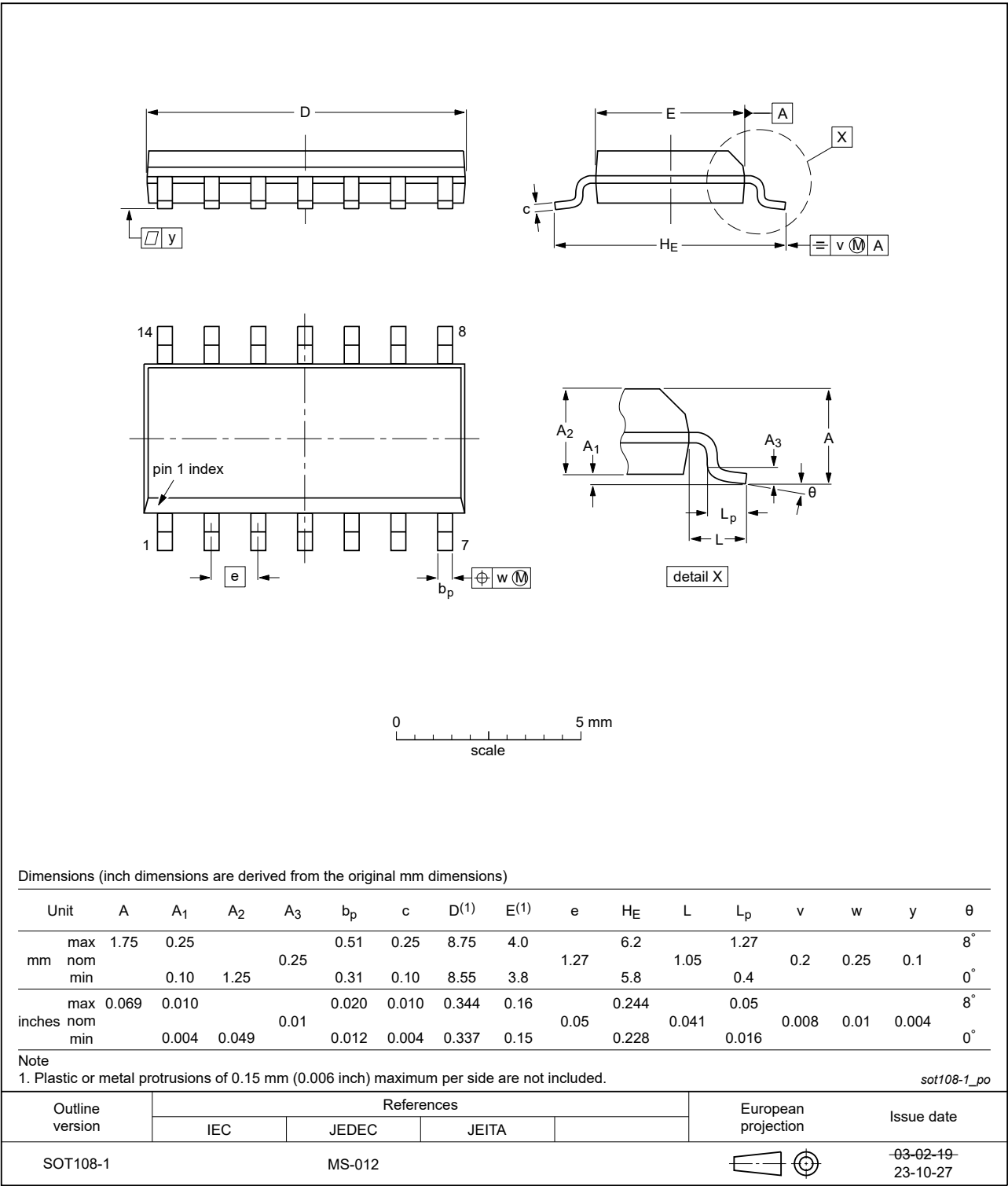


Fig. 7. Package outline SOT108-1 (SO14)

TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm

SOT402-1

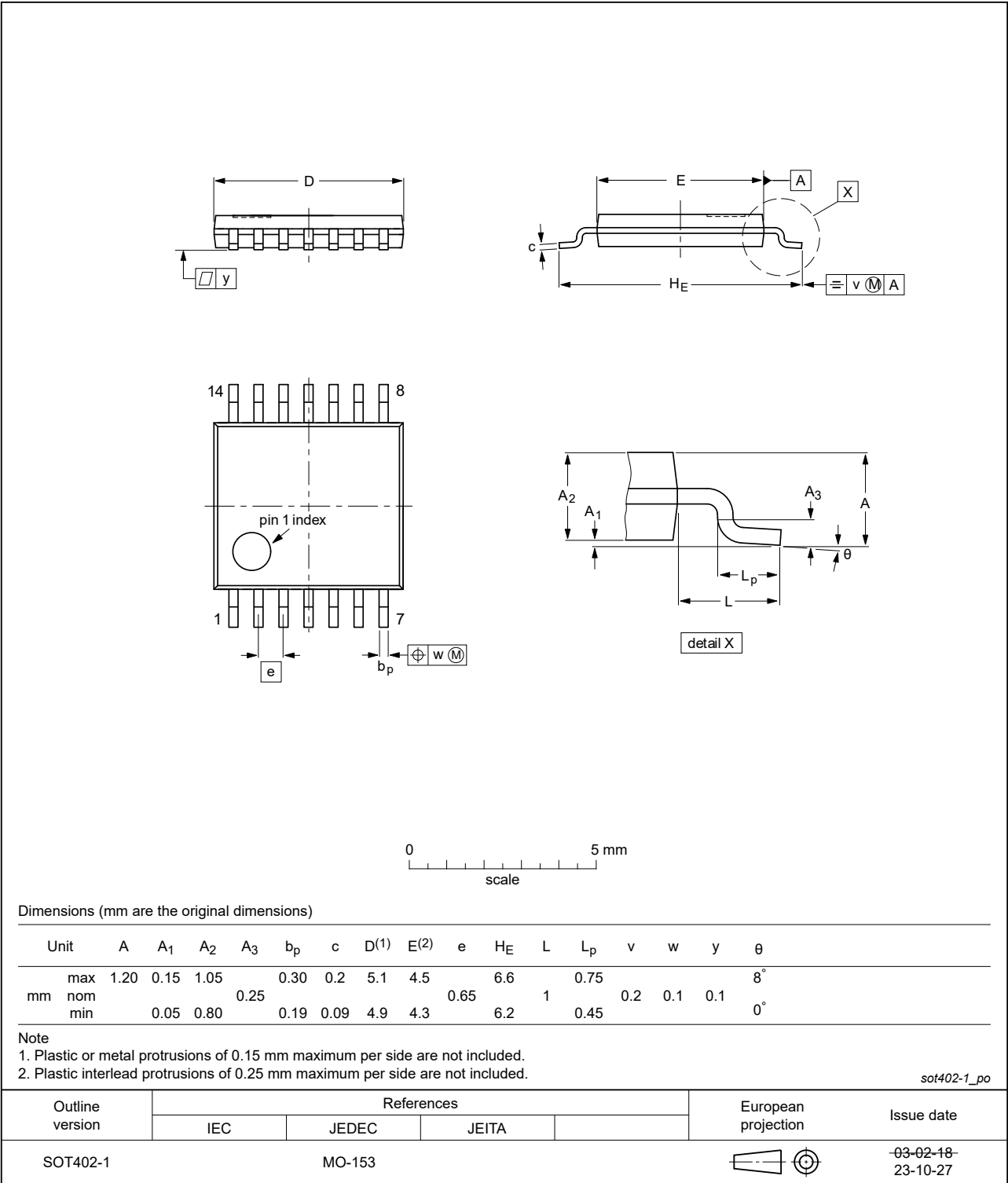


Fig. 8. Package outline SOT402-1 (TSSOP14)

12. 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

13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT107_Q100 v.4	20240220	Product data sheet	-	74HC_HCT107_Q100 v.3
Modifications:	<ul style="list-style-type: none"><li>Section 2: ESD specification updated according to the latest JEDEC standard.</li><li>Fig. 7, Fig. 8: Aligned SO and TSSOP package outline drawings to JEDEC MS-012 and MO-153</li></ul>			
74HC_HCT107_Q100 v.3	20210707	Product data sheet	-	74HC_HCT107_Q100 v.2
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>Section 2 updated.</li><li>Section 7: Derating values for P<sub>tot</sub> total power dissipation have changed.</li></ul>			
74HC_HCT107_Q100 v.2	20150126	Product data sheet	-	74HC_HCT107_Q100 v.1
Modifications:	<ul style="list-style-type: none"><li>Table 7: Power dissipation capacitance condition for 74HCT107-Q100 is corrected.</li></ul>			
74HC_HCT107_Q100 v.1	20131118	Product data sheet	-	-

## 14. 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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Date of release: 20 February 2024

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