

# 74LV74-Q100

Dual D-type flip-flop with set and reset; positive-edge trigger

Rev. 2 — 24 March 2021

Product data sheet

## 1. General description

The 74LV74-Q100 is a dual positive edge triggered D-type flip-flop with individual data (nD), clock (nCP), set (nSD) and reset (nRD) inputs, and complementary nQ and nQ outputs. Data at the D-input that meets the set-up and hold time requirements on the LOW-to-HIGH clock transition will be stored in the flip-flop and appear at the nQ output. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess  $V_{CC}$ .

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 1.0 V to 5.5 V
- Optimized for low voltage applications from 1.0 V to 3.6 V
- CMOS low power dissipation
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Direct interface with TTL levels (2.7 V to 3.6 V)
- ESD protection:
  - MIL-STD-883C, 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. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LV74D-Q100	-40 °C to +125 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1
74LV74PW-Q100	-40 °C to +125 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1

### 4. Functional diagram

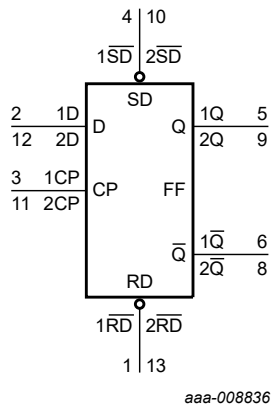


Fig. 1. Logic symbol

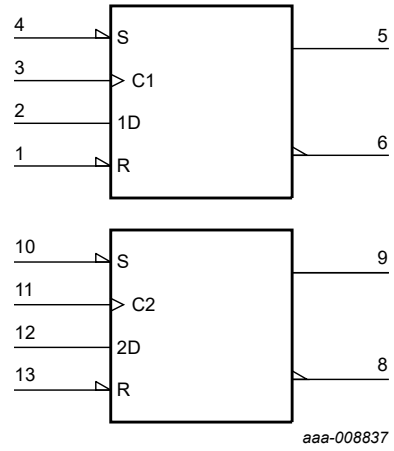


Fig. 2. IEC logic symbol

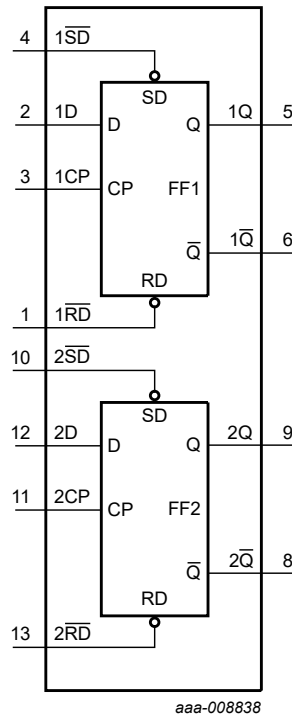


Fig. 3. Functional diagram

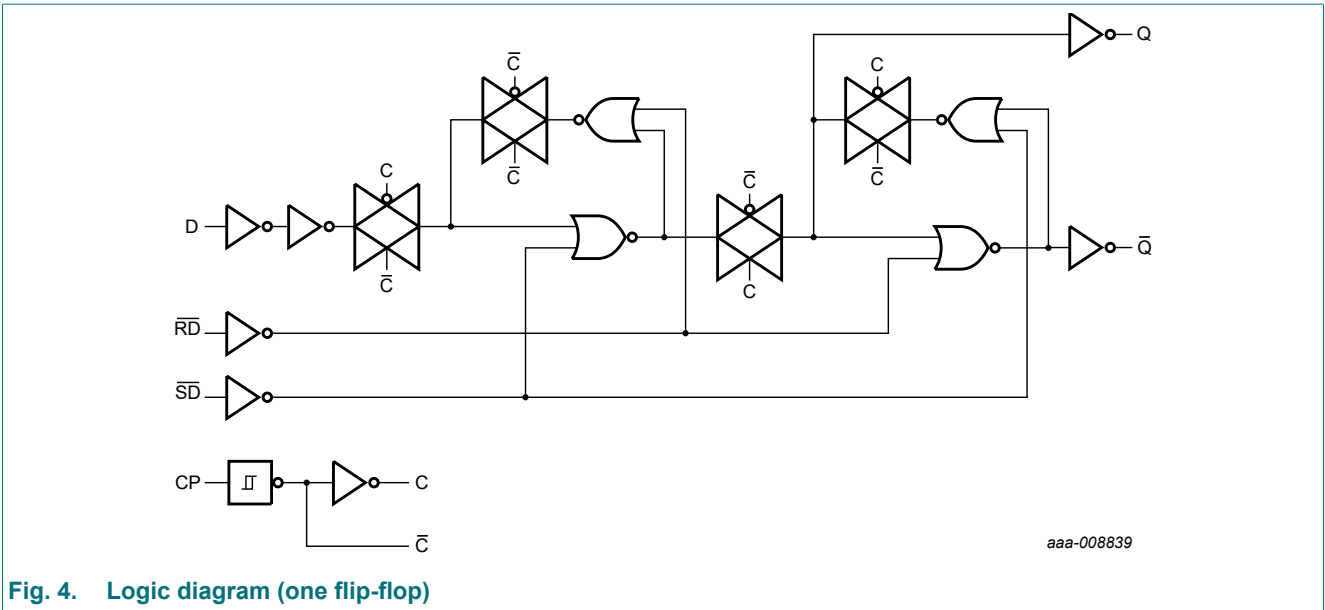


Fig. 4. Logic diagram (one flip-flop)

## 5. Pinning information

### 5.1. Pinning

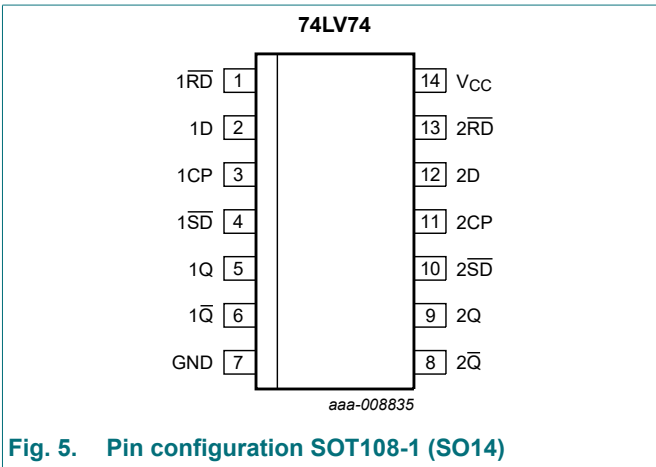


Fig. 5. Pin configuration SOT108-1 (SO14)

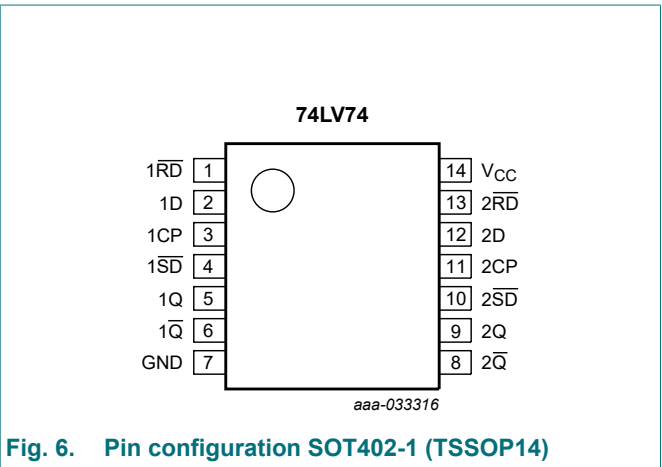


Fig. 6. Pin configuration SOT402-1 (TSSOP14)

### 5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
1RD, 2RD	1, 13	asynchronous reset-direct input (active-LOW)
1D, 2D	2, 12	data inputs
1CP, 2CP	3, 11	clock input (LOW-to-HIGH), edge-triggered
1SD, 2SD	4, 10	asynchronous set-direct input (active-LOW)
1Q, 2Q	5, 9	true flip-flop outputs
1Q-bar, 2Q-bar	6, 8	complement flip-flop outputs
GND	7	ground (0 V)
V <sub>CC</sub>	14	supply voltage

## 6. Functional description

**Table 3. Function table**

H = HIGH voltage level; L = LOW voltage level; X = don't care;

↑ = LOW-to-HIGH clock transition;  $Q_{n+1}$  = state after the next LOW-to-HIGH CP transition

Input				Output			
nSD	nRD	nCP	nD	nQ	nQ	$Q_{n+1}$	$n\bar{Q}_{n+1}$
L	H	X	X	H	L	-	-
H	L	X	X	L	H	-	-
L	L	X	X	H	H	-	-
H	H	↑	L	-	-	L	H
H	H	↑	H	-	-	H	L

## 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
$V_{CC}$	supply voltage	[1]	-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
$V_I$	input voltage	[1]	-0.5	+7	V
$I_{OK}$	output clamping current	$V_O > V_{CC}$ or $V_O < 0$	-	±50	mA
$I_O$	output current	$-0.5\text{ V} < V_O < V_{CC} + 0.5\text{ V}$	-	±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	$T_{amb} = -40\text{ °C}$ to $+125\text{ °C}$ [2]	-	500	

[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:  $P_{tot}$  derates linearly with 10.1 mW/K above 100 °C.

For SOT402-1 (TSSOP14) package:  $P_{tot}$  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	Min	Typ	Max	Unit
$V_{CC}$	supply voltage [1]		1.0	3.3	5.5	V
$V_I$	input voltage		0	-	$V_{CC}$	V
$V_O$	output voltage		0	-	$V_{CC}$	V
$T_{amb}$	ambient temperature		-40	-	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 1.0\text{ V to }2.0\text{ V}$	0	-	500	ns/V
		$V_{CC} = 2.0\text{ V to }2.7\text{ V}$	0	-	200	ns/V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	0	-	100	ns/V
		$V_{CC} = 3.6\text{ V to }5.5\text{ V}$	0	-	50	ns/V

[1] 74LV74 is guaranteed to function down to  $V_{CC} = 1.0\text{ V}$  (input levels GND or  $V_{CC}$ ); DC characteristics are guaranteed from  $V_{CC} = 1.2\text{ V to }V_{CC} = 5.5\text{ V}$ .

## 9. Static characteristics

**Table 6. Static characteristics**

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

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 1.2 V	0.9	-	-	0.9	-	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.4	-	-	1.4	-	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	2.0	-	-	2.0	-	V
		V <sub>CC</sub> = 4.5 V to 5.5 V	0.7V <sub>CC</sub>	-	-	0.7V <sub>CC</sub>	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 1.2 V	-	-	0.3	-	0.3	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	-	0.6	-	0.6	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	-	-	0.8	-	0.8	V
		V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	0.3V <sub>CC</sub>	-	0.3V <sub>CC</sub>	
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> = -100 µA						
		V <sub>CC</sub> = 1.2 V	-	1.2		-		
		V <sub>CC</sub> = 2.0 V	1.8	2.0	-	1.8	-	V
		V <sub>CC</sub> = 2.7 V	2.5	2.7	-	2.5	-	V
		V <sub>CC</sub> = 3.0 V	2.8	3.0	-	2.8	-	V
		V <sub>CC</sub> = 4.5 V	4.3	4.5	-	4.3	-	V
		standard outputs: V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>						
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = -6 mA	2.40	2.82	-	2.20	-	V
V <sub>CC</sub> = 4.5 V; I <sub>O</sub> = -12 mA	3.60	4.20	-	3.50	-	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> = 100 µA						
		V <sub>CC</sub> = 1.2 V	-	0	-	-	-	
		V <sub>CC</sub> = 2.0 V	-	0	0.2		0.2	V
		V <sub>CC</sub> = 2.7 V	-	0	0.2		0.2	V
		V <sub>CC</sub> = 3.0 V	-	0	0.2		0.2	V
		V <sub>CC</sub> = 4.5 V	-	0	0.2		0.2	V
		standard outputs: V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>						
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = 6 mA	-	0.25	0.40	-	0.50	V
V <sub>CC</sub> = 4.5 V; I <sub>O</sub> = 12 mA	-	0.35	0.55	-	0.65	V		
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	-	-	±1	-	±1	µA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	20	-	80	µA
ΔI <sub>CC</sub>	additional supply current	V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; V <sub>CC</sub> = 2.7 V to 3.6 V	-	-	500	-	850	µA
C <sub>I</sub>	input capacitance		-	3.5	-			pF

[1] Typical values are measured at T<sub>amb</sub> = 25 °C.

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

GND (ground = 0 V): for test circuit, see Fig. 9

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
$t_{pd}$	propagation delay	nCP to nQ, n $\bar{Q}$ ; see Fig. 7 [2]						
		$V_{CC} = 1.2\text{ V}$	-	70	-	-	-	ns
		$V_{CC} = 2.0\text{ V}$	-	24	44	-	56	ns
		$V_{CC} = 2.7\text{ V}$	-	18	28	-	41	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$ [3]	-	13	26	-	33	ns
		$V_{CC} = 3.3\text{ V}; C_L = 15\text{ pF}$	-	11	-	-	-	ns
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$ [4]	-	9.5	17	-	23	ns
		n $\bar{S}\bar{D}$ to nQ, n $\bar{Q}$ ; see Fig. 8						
		$V_{CC} = 1.2\text{ V}$	-	90	-	-	-	ns
		$V_{CC} = 2.0\text{ V}$	-	31	46	-	58	ns
		$V_{CC} = 2.7\text{ V}$	-	23	34	-	43	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$ [3]	-	17	27	-	34	ns
		$V_{CC} = 3.3\text{ V}; C_L = 15\text{ pF}$	-	14	-	-	-	ns
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$ [4]	-	12	19	-	24	ns
		n $\bar{R}\bar{D}$ to nQ, n $\bar{Q}$ ; see Fig. 8						
		$V_{CC} = 1.2\text{ V}$	-	90	-	-	-	ns
		$V_{CC} = 2.0\text{ V}$	-	31	46	-	58	ns
		$V_{CC} = 2.7\text{ V}$	-	23	34	-	43	ns
$V_{CC} = 3.0\text{ V to }3.6\text{ V}$ [3]	-	17	27	-	34	ns		
$V_{CC} = 3.3\text{ V}; C_L = 15\text{ pF}$	-	14	-	-	-	ns		
$V_{CC} = 4.5\text{ V to }5.5\text{ V}$ [4]	-	12	19	-	24	ns		
$t_w$	pulse width	nCP input HIGH to LOW; see Fig. 7						
		$V_{CC} = 2.0\text{ V}$	34	10	-	41	-	ns
		$V_{CC} = 2.7\text{ V}$	25	8	-	30	-	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$ [3]	20	7	-	24	-	ns
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$ [4]	15	6	-	18	-	ns
		n $\bar{S}\bar{D}$ or n $\bar{R}\bar{D}$ pulse width LOW; see Fig. 8						
		$V_{CC} = 2.0\text{ V}$	34	10	-	41	-	ns
		$V_{CC} = 2.7\text{ V}$	25	8	-	30	-	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$ [3]	20	7	-	24	-	ns
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$ [4]	15	6	-	18	-	ns
$t_{rec}$	recovery time	n $\bar{R}\bar{D}$ ; see Fig. 8						
		$V_{CC} = 1.2\text{ V}$	-	5	-	-	-	ns
		$V_{CC} = 2.0\text{ V}$	14	2	-	15	-	ns
		$V_{CC} = 2.7\text{ V}$	10	1	-	11	-	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$ [3]	8	1	-	9	-	ns
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$ [4]	6	1	-	7	-	ns

## Dual D-type flip-flop with set and reset; positive-edge trigger

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
t <sub>su</sub>	set-up time	nD to nCP; see Fig. 7						
		V <sub>CC</sub> = 1.2 V	-	10	-	-	-	ns
		V <sub>CC</sub> = 2.0 V	22	4	-	26	-	ns
		V <sub>CC</sub> = 2.7 V	12	3	-	15	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V [3]	8	2	-	10	-	ns
V <sub>CC</sub> = 4.5 V to 5.5 V [4]	6	1	-	8	-	ns		
t <sub>h</sub>	hold time	nD to nCP; see Fig. 7						
		V <sub>CC</sub> = 1.2 V	-	-10	-	-	-	ns
		V <sub>CC</sub> = 2.0 V	3	-2	-	3	-	ns
		V <sub>CC</sub> = 2.7 V	3	-2	-	3	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V [3]	3	-2	-	3	-	ns
V <sub>CC</sub> = 4.5 V to 5.5 V [4]	3	-2	-	3	-	ns		
f <sub>max</sub>	maximum frequency	nCP; see Fig. 7						
		V <sub>CC</sub> = 2.0 V	14	40	-	12	-	MHz
		V <sub>CC</sub> = 2.7 V	50	90	-	40	-	MHz
		V <sub>CC</sub> = 3.0 V to 3.6 V [3]	60	100	-	48	-	MHz
V <sub>CC</sub> = 4.5 V to 5.5 V [4]	70	110	-	56	-	MHz		
C <sub>PD</sub>	power dissipation capacitance	V <sub>I</sub> = GND to V <sub>CC</sub> [5]	-	24	-	-	-	pF

[1] Typical values are measured at T<sub>amb</sub> = 25 °C.

[2] t<sub>pd</sub> is the same as t<sub>PHL</sub> and t<sub>PLH</sub>.

[3] Typical value measured at V<sub>CC</sub> = 3.3 V.

[4] Typical values are measured at V<sub>CC</sub> = 5.0 V.

[5] C<sub>PD</sub> is used to determine the dynamic power dissipation  $P_D = C_{PD} \times V_{CC}^2 \times f_i + \Sigma(C_L \times V_{CC}^2 \times f_o)$  (P<sub>D</sub> in μW), where:

f<sub>i</sub> = input frequency in MHz;

f<sub>o</sub> = output frequency in MHz;

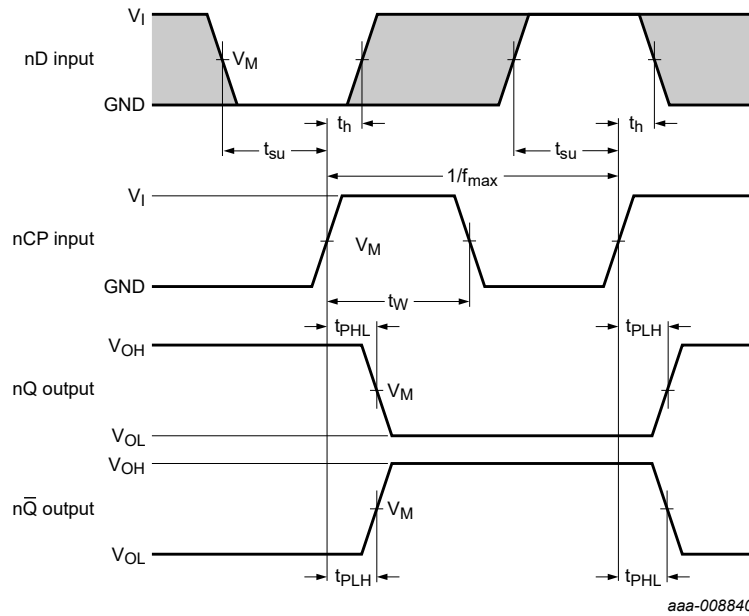
Σ(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of outputs;

C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = supply voltage in V.

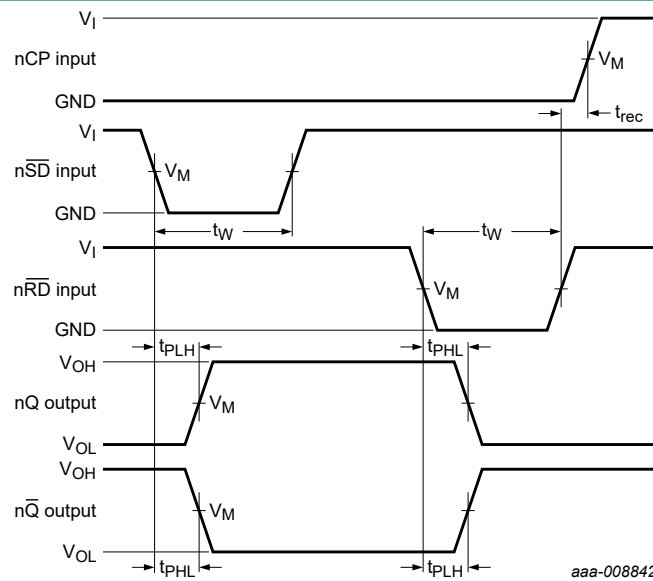


10.1. Waveforms and test circuit



Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.  
 The shaded areas indicate when the input is permitted to change for predictable output performance.

Fig. 7. Clock pulse (nCP) to output (nQ, nQ-bar) propagation delays, nCP pulse width and maximum frequency



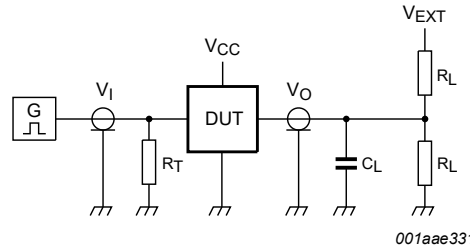
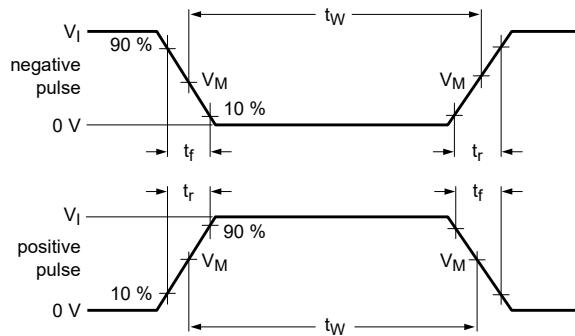
Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.

Fig. 8. The set (nSD) and reset (nRD) input to output (nQ, nQ-bar) propagation delays, the set and reset pulse widths and the nRD to nCP recovery time

Dual D-type flip-flop with set and reset; positive-edge trigger

Table 8. Measurement points

Supply voltage	Input	Output
$V_{CC}$	$V_M$	$V_M$
< 2.7 V	$0.5V_{CC}$	$0.5V_{CC}$
2.7 V to 3.6 V	1.5 V	1.5 V
$\geq 4.5$ V	$0.5V_{CC}$	$0.5V_{CC}$



001aae331

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

Definitions for test circuit:

$R_L$  = Load resistance.

$C_L$  = Load capacitance including jig and probe capacitance.

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

$V_{EXT}$  = External voltage for measuring switching times.

Fig. 9. Test circuit for measuring switching times

Table 9. Test data

Supply voltage	Input		Load		$V_{EXT}$
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$
< 2.7 V	$V_{CC}$	2.5 ns	50 pF	1 k $\Omega$	open
2.7 V to 3.6 V	2.7 V	2.5 ns	50 pF, 15 pF	1 k $\Omega$	open
$\geq 4.5$ V	$V_{CC}$	2.5 ns	50 pF	1 k $\Omega$	open

### 11. Package outline

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

SOT108-1

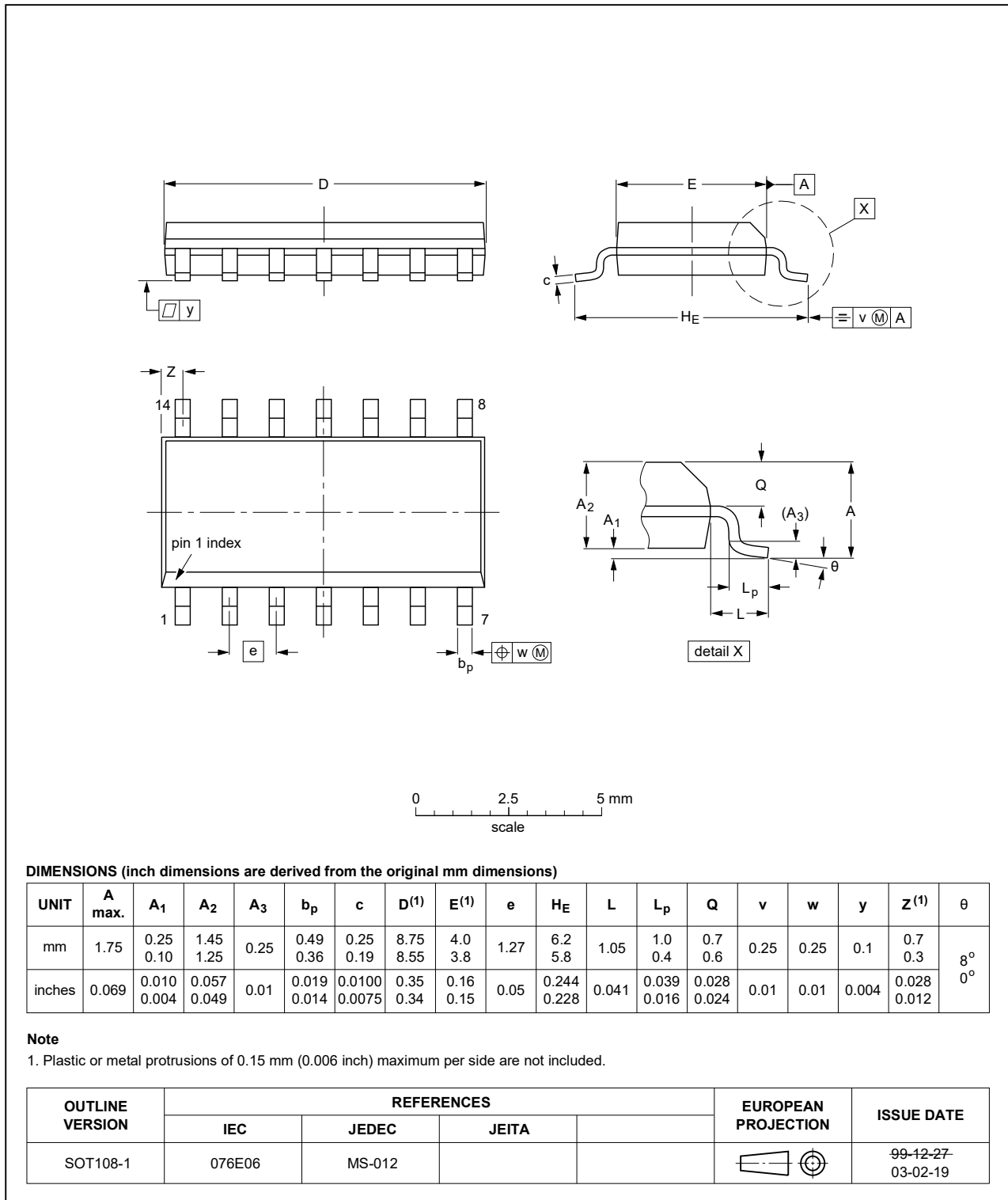


Fig. 10. Package outline SOT108-1 (SO14)

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

SOT402-1

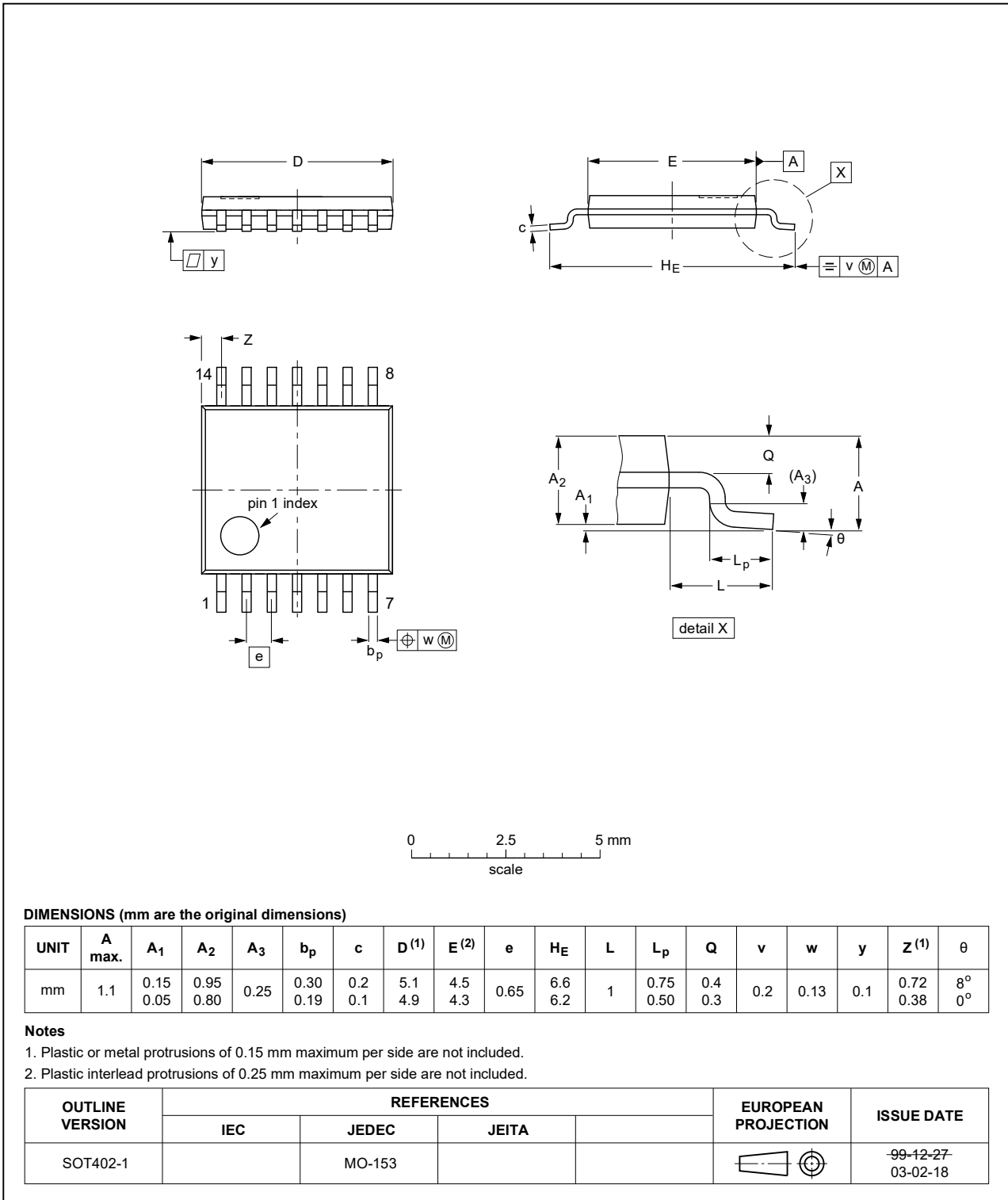


Fig. 11. Package outline SOT402-1 (TSSOP14)

## 12. Abbreviations

Table 10. Abbreviations

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

## 13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LV74_Q100 v.2	20210324	Product data sheet	-	74LV74_Q100 v.1
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><a href="#">Section 1</a> and <a href="#">Section 2</a> updated.</li> <li><a href="#">Section 7</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li> </ul>			
74LV74_Q100 v.1	20130923	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".
- [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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