

# 74LVC273

Octal D-type flip-flop with reset; positive-edge trigger

Rev. 7 — 28 August 2020

Product data sheet

## 1. General description

The 74LVC273 is an octal positive-edge triggered D-type flip-flop. The device features clock (CP) and master reset ( $\overline{MR}$ ) inputs. The outputs Qn will assume the state of their corresponding D inputs that meet the set-up and hold time requirements on the LOW-to-HIGH clock (CP) transition. A LOW on  $\overline{MR}$  forces the outputs LOW independently of clock and data inputs. Inputs can be driven from either 3.3 V or 5 V devices. This feature allows the use of these devices as translators in mixed 3.3 V and 5 V environments.

Schmitt-trigger action at all inputs makes the circuit tolerant of slower input rise and fall times.

## 2. Features and benefits

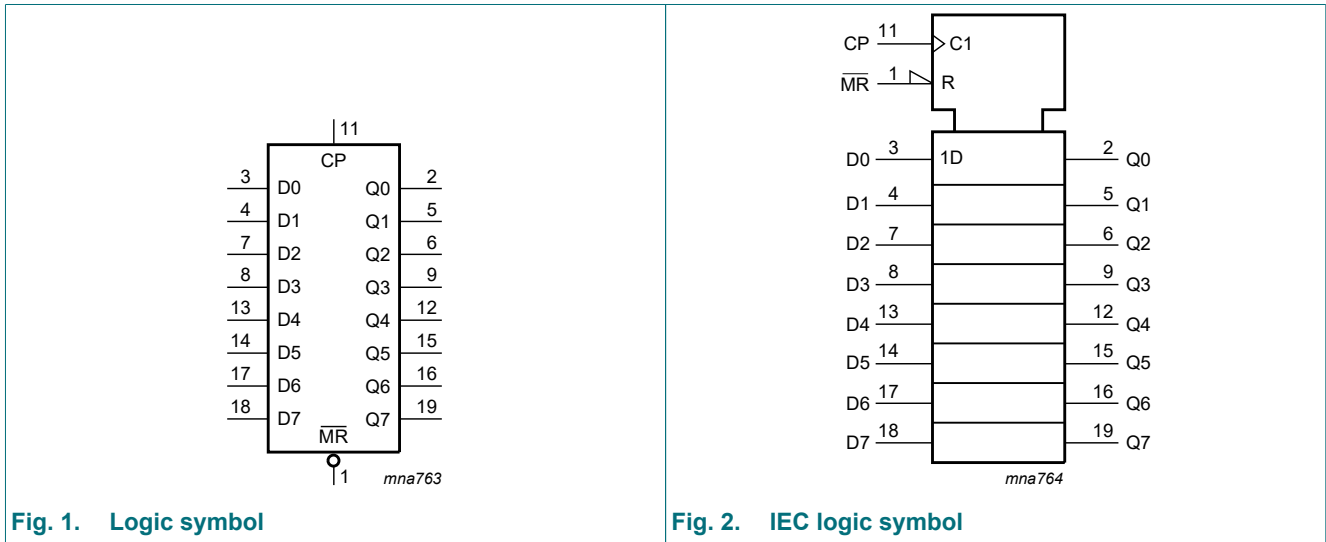
- Wide supply voltage range from 1.2 V to 3.6 V
- Overvoltage tolerant inputs to 5.5 V
- CMOS low power consumption
- Direct interface with TTL levels
- Output drive capability 50  $\Omega$  transmission lines at +85 °C
- Complies with JEDEC standard:
  - JESD8-7A (1.65 V to 1.95 V)
  - JESD8-5A (2.3 V to 2.7 V)
  - JESD8-C/JESD36 (2.7 V to 3.6 V)
- ESD protection:
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-B exceeds 200 V
  - CDM JESD22-C101E exceeds 1000 V
- Specified from -40 °C to +85 °C and -40 °C to +125 °C

## 3. Ordering information

Table 1. Ordering information

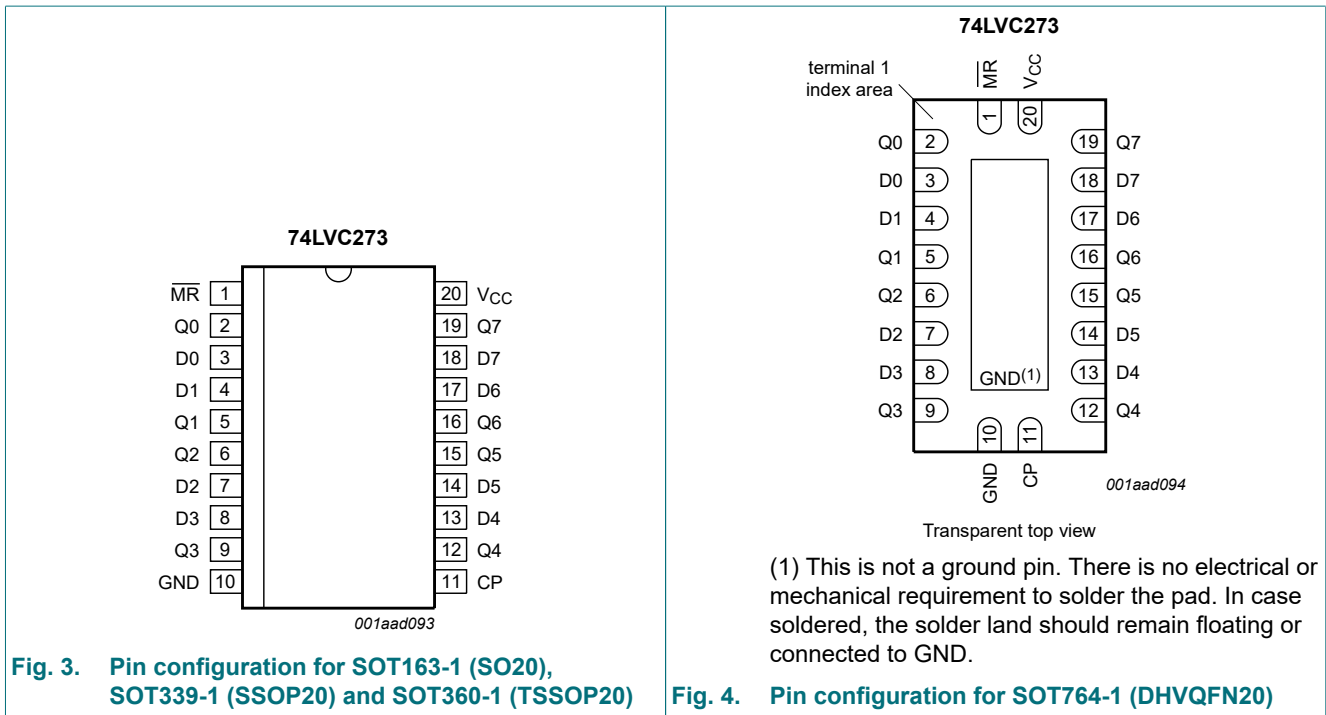
Type number	Package			
	Temperature range	Name	Description	Version
74LVC273D	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74LVC273DB	-40 °C to +125 °C	SSOP20	plastic shrink small outline package; 20 leads; body width 5.3 mm	SOT339-1
74LVC273PW	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74LVC273BQ	-40 °C to +125 °C	DHVQFN20	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body 2.5 × 4.5 × 0.85 mm	SOT764-1

### 4. Functional diagram



### 5. Pinning information

#### 5.1. Pinning



## 5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
MR	1	master reset input (active LOW)
CP	11	clock input (LOW-to-HIGH; edge-triggered)
D0, D1, D2, D3, D4, D5, D6, D7	3, 4, 7, 8, 13, 14, 17, 18	data input
Q0, Q1, Q2, Q3, Q4, Q5, Q6, Q7	2, 5, 6, 9, 12, 15, 16, 19	flip-flop output
GND	10	ground (0 V)
V <sub>CC</sub>	20	supply voltage

## 6. Functional description

Table 3. Function table

H = HIGH voltage level; h = HIGH voltage level one set-up time prior to the LOW-to-HIGH CP transition

L = LOW voltage level; l = LOW voltage level one set-up time prior to the LOW-to-HIGH CP transition

X = don't care; ↑ = LOW-to-HIGH clock transition

Operating mode	Input			Output
	MR	CP	Dn	Qn
Reset (clear)	L	X	X	L
Load '1'	H	↑	h	H
Load '0'	H	↑	l	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 <sub>CC</sub>	supply voltage		-0.5	+6.5	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < 0 V	-50	-	mA
V <sub>I</sub>	input voltage		[1] -0.5	+6.5	V
I <sub>OK</sub>	output clamping current	V <sub>O</sub> > V <sub>CC</sub> or V <sub>O</sub> < 0 V	-	50	mA
V <sub>O</sub>	output voltage		[2] -0.5	V <sub>CC</sub> + 0.5	V
I <sub>O</sub>	output current	V <sub>O</sub> = 0 V to V <sub>CC</sub>	-	±50	mA
I <sub>CC</sub>	supply current		-	100	mA
I <sub>GND</sub>	ground current		-100	-	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	[3] -	500	mW

[1] The minimum input voltage ratings may be exceeded if the input current ratings are observed.

[2] The output voltage ratings may be exceeded if the output current ratings are observed.

[3] For SOT163-1 (SO20) package: P<sub>tot</sub> derates linearly with 12.3 mW/K above 109 °C.

For SOT339-1 (SSOP20) package: P<sub>tot</sub> derates linearly with 10.0 mW/K above 100 °C.

For SOT360-1 (TSSOP20) package: P<sub>tot</sub> derates linearly with 10.0 mW/K above 100 °C.

For SOT764-1 (DHVQFN20) package: P<sub>tot</sub> derates linearly with 12.9 mW/K above 111 °C.

## 8. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>CC</sub>	supply voltage		1.65	-	3.6	V
		functional	1.2	-	-	V
V <sub>I</sub>	input voltage		0	-	5.5	V
V <sub>O</sub>	output voltage		0	-	V <sub>CC</sub>	V
T <sub>amb</sub>	ambient temperature	in free air	-40	-	+125	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 1.65 V to 2.7 V	0	-	20	ns/V
		V <sub>CC</sub> = 2.7 V to 3.6 V	0	-	10	ns/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	1.08	-	-	1.08	-	V
		V <sub>CC</sub> = 1.65 V to 1.95 V	0.65V <sub>CC</sub>	-	-	0.65V <sub>CC</sub>	-	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.7	-	-	1.7	-	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	2.0	-	-	2.0	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 1.2 V	-	-	0.12	-	0.12	V
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	-	0.35V <sub>CC</sub>	-	0.35V <sub>CC</sub>	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	-	0.7	-	0.7	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	-	-	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>						
		I <sub>O</sub> = -100 μA; V <sub>CC</sub> = 1.65 V to 3.6 V	V <sub>CC</sub> - 0.2	-	-	V <sub>CC</sub> - 0.3	-	V
		I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 1.65 V	1.2	-	-	1.05	-	V
		I <sub>O</sub> = -8 mA; V <sub>CC</sub> = 2.3 V	1.8	-	-	1.65	-	V
		I <sub>O</sub> = -12 mA; V <sub>CC</sub> = 2.7 V	2.2	-	-	2.05	-	V
		I <sub>O</sub> = -18 mA; V <sub>CC</sub> = 3.0 V	2.4	-	-	2.25	-	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> = 1.65 V to 3.6 V	-	-	0.2	-	0.3	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V	-	-	0.45	-	0.65	V
		I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V	-	-	0.6	-	0.8	V
		I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V	-	-	0.4	-	0.6	V
		I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V	-	-	0.55	-	0.8	V

## Octal D-type flip-flop with reset; positive-edge trigger

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
$I_I$	input leakage current	$V_{CC} = 3.6\text{ V}$ ; $V_I = 5.5\text{ V}$ or GND	-	$\pm 0.1$	$\pm 5$	-	$\pm 20$	$\mu\text{A}$
$I_{CC}$	supply current	$V_{CC} = 3.6\text{ V}$ ; $V_I = V_{CC}$ or GND; $I_O = 0\text{ A}$	-	0.1	10	-	40	$\mu\text{A}$
$\Delta I_{CC}$	additional supply current	per input pin; $V_{CC} = 2.7\text{ V}$ to $3.6\text{ V}$ ; $V_I = V_{CC} - 0.6\text{ V}$ ; $I_O = 0\text{ A}$	-	5	500	-	5000	$\mu\text{A}$
$C_I$	input capacitance	$V_{CC} = 0\text{ V}$ to $3.6\text{ V}$ ; $V_I = \text{GND}$ to $V_{CC}$	-	5.0	-	-	-	pF

[1] All typical values are measured at  $V_{CC} = 3.3\text{ V}$  (unless stated otherwise) and  $T_{\text{amb}} = 25\text{ °C}$ .

## 10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). For test circuit see Fig. 8.

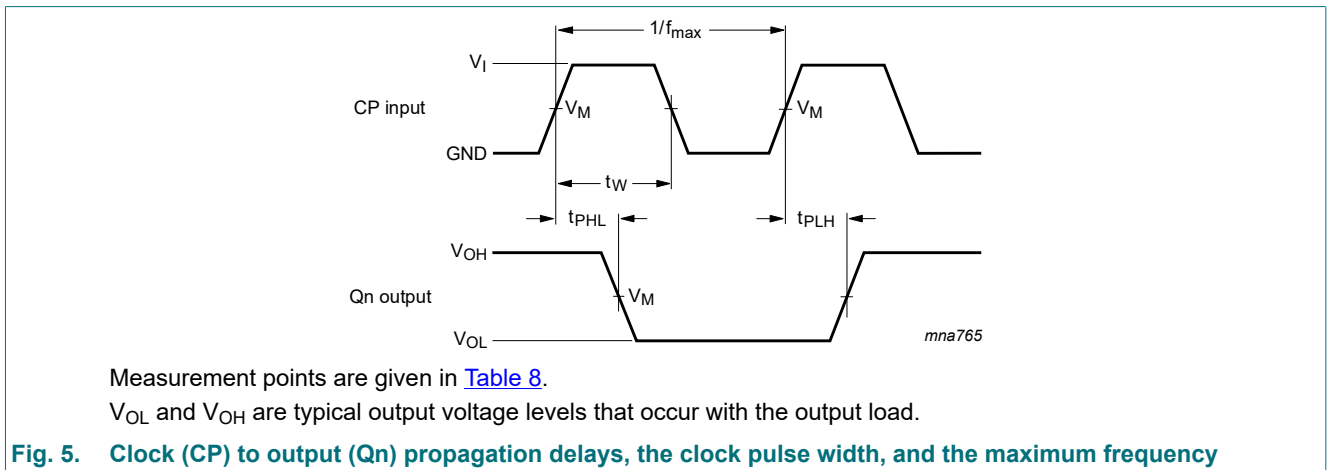
Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
$t_{pd}$	propagation delay	CP to Qn; see Fig. 5 [2]						
		$V_{CC} = 1.2\text{ V}$	-	18	-	-	-	ns
		$V_{CC} = 1.65\text{ V}$ to $1.95\text{ V}$	2.5	9.7	19.2	2.5	22.2	ns
		$V_{CC} = 2.3\text{ V}$ to $2.7\text{ V}$	1.8	4.9	9.9	1.8	11.4	ns
		$V_{CC} = 2.7\text{ V}$	1.5	4.5	8.4	1.5	10.5	ns
$t_{PHL}$	HIGH to LOW propagation delay	$\overline{\text{MR}}$ to Qn; see Fig. 6						
		$V_{CC} = 1.2\text{ V}$	-	18	-	-	-	ns
		$V_{CC} = 1.65\text{ V}$ to $1.95\text{ V}$	2.4	10.2	20.4	2.4	23.5	ns
		$V_{CC} = 2.3\text{ V}$ to $2.7\text{ V}$	1.7	5.2	10.5	1.7	12.1	ns
		$V_{CC} = 2.7\text{ V}$	1.5	4.7	8.9	1.5	11.5	ns
$t_W$	pulse width	clock HIGH or LOW; see Fig. 5						
		$V_{CC} = 1.65\text{ V}$ to $1.95\text{ V}$	6.0	-	-	6.0	-	ns
		$V_{CC} = 2.3\text{ V}$ to $2.7\text{ V}$	5.0	-	-	5.0	-	ns
		$V_{CC} = 2.7\text{ V}$	5.0	1.8	-	5.0	-	ns
		$V_{CC} = 3.0\text{ V}$ to $3.6\text{ V}$	4.0	1.2	-	4.0	-	ns
		master reset LOW; see Fig. 6						
		$V_{CC} = 1.65\text{ V}$ to $1.95\text{ V}$	6.0	-	-	6.0	-	ns
		$V_{CC} = 2.3\text{ V}$ to $2.7\text{ V}$	5.0	-	-	5.0	-	ns
		$V_{CC} = 2.7\text{ V}$	5.0	1.7	-	5.0	-	ns
$t_{rec}$	recovery time	$\overline{\text{MR}}$ to CP; see Fig. 6						
		$V_{CC} = 1.65\text{ V}$ to $1.95\text{ V}$	2.0	-	-	2.0	-	ns
		$V_{CC} = 2.3\text{ V}$ to $2.7\text{ V}$	2.0	-	-	2.0	-	ns
		$V_{CC} = 2.7\text{ V}$	2.0	-1.0	-	2.0	-	ns
		$V_{CC} = 3.0\text{ V}$ to $3.6\text{ V}$	2.0	-1.0	-	2.0	-	ns

Octal D-type flip-flop with reset; positive-edge trigger

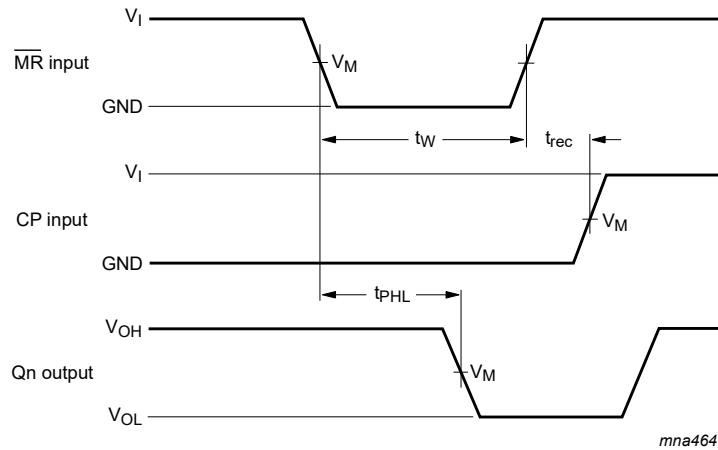
Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
t <sub>su</sub>	set-up time	Dn to CP; see Fig. 7						
		V <sub>CC</sub> = 1.65 V to 1.95 V	5.0	-	-	5.0	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	3.5	-	-	3.5	-	ns
		V <sub>CC</sub> = 2.7 V	3.0	1.0	-	3.0	-	ns
t <sub>h</sub>	hold time	Dn to CP; see Fig. 7						
		V <sub>CC</sub> = 1.65 V to 1.95 V	3.0	-	-	3.0	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	2.5	-	-	2.5	-	ns
		V <sub>CC</sub> = 2.7 V	2.0	-0.2	-	2.0	-	ns
f <sub>max</sub>	maximum frequency	see Fig. 5						
		V <sub>CC</sub> = 1.65 V to 1.95 V	80	-	-	64	-	MHz
		V <sub>CC</sub> = 2.3 V to 2.7 V	100	-	-	80	-	MHz
		V <sub>CC</sub> = 2.7 V	150	-	-	150	-	MHz
t <sub>sk(o)</sub>	output skew time	V <sub>CC</sub> = 3.0 V to 3.6 V [3]	-	-	1.0	-	1.5	ns
		C <sub>PD</sub>	per flip-flop; V <sub>I</sub> = GND to V <sub>CC</sub> [4]					
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	14.0	-	-	-	pF
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	17.7	-	-	-	pF
C <sub>PD</sub>	power dissipation capacitance	V <sub>CC</sub> = 3.0 V to 3.6 V	-	21.0	-	-	-	pF

- [1] Typical values are measured at T<sub>amb</sub> = 25 °C and V<sub>CC</sub> = 1.2 V, 1.8 V, 2.5 V, 2.7 V and 3.3 V respectively.
- [2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.
- [3] Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.
- [4] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o)$  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 Volt  
 N = number of inputs switching  
 $\sum(C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs

10.1. Waveforms and test circuit



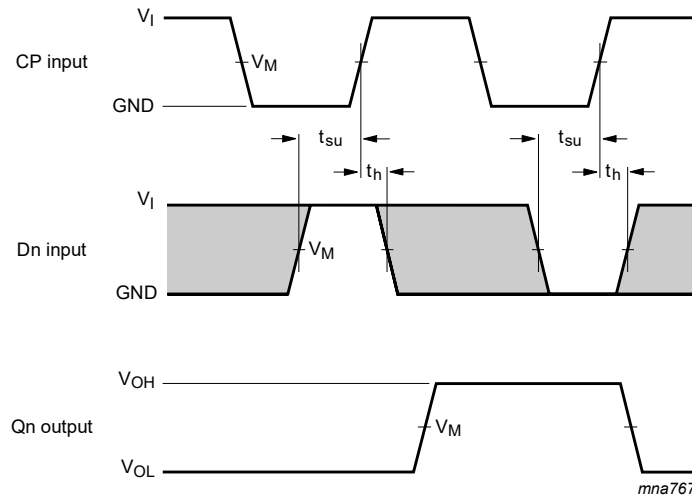
Octal D-type flip-flop with reset; positive-edge trigger



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

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

**Fig. 6. Master reset ( $\overline{MR}$ ) pulse width, the master reset to output ( $Q_n$ ) propagation delays, and the master reset to clock (CP) recovery time**



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

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

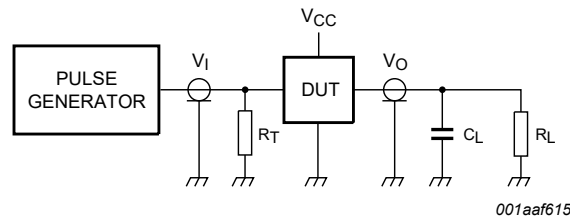
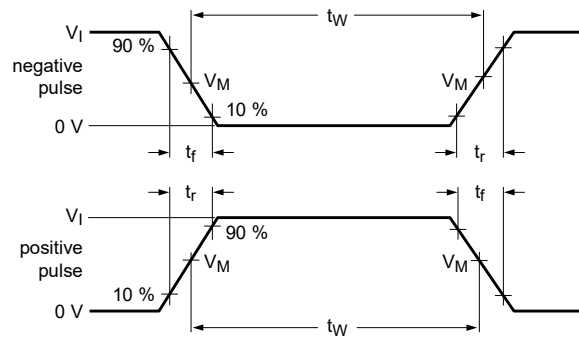
The shaded areas indicate when the input is permitted to change for predictable output performance.

**Fig. 7. Data set-up and hold times for the data input ( $D_n$ )**

**Table 8. Measurement points**

Supply voltage	Input		Output		
	$V_I$	$V_M$	$V_M$	$V_X$	$V_Y$
1.2 V	$V_{CC}$	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
1.65 V to 1.95 V	$V_{CC}$	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
2.3 V to 2.7 V	$V_{CC}$	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
2.7 V	2.7 V	1.5 V	1.5 V	$V_{OL} + 0.3 \text{ V}$	$V_{OH} - 0.3 \text{ V}$
3.0 V to 3.6 V	2.7 V	1.5 V	1.5 V	$V_{OL} + 0.3 \text{ V}$	$V_{OH} - 0.3 \text{ V}$

Octal D-type flip-flop with reset; positive-edge trigger



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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.

**Fig. 8. Test circuit for measuring switching times**

**Table 9. Test data**

Supply voltage	Input		Load		$V_{EXT}$		
$V_{CC}$	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PLH}, t_{PHL}$	$t_{PLZ}, t_{PZL}$	$t_{PHZ}, t_{PZH}$
1.2 V	$V_{CC}$	$\leq 2$ ns	30 pF	1 k $\Omega$	open	$2 \times V_{CC}$	GND
1.65 V to 1.95 V	$V_{CC}$	$\leq 2$ ns	30 pF	1 k $\Omega$	open	$2 \times V_{CC}$	GND
2.3 V to 2.7 V	$V_{CC}$	$\leq 2$ ns	30 pF	500 $\Omega$	open	$2 \times V_{CC}$	GND
2.7 V	2.7 V	$\leq 2.5$ ns	50 pF	500 $\Omega$	open	$2 \times V_{CC}$	GND
3.0 V to 3.6 V	2.7 V	$\leq 2.5$ ns	50 pF	500 $\Omega$	open	$2 \times V_{CC}$	GND



### 11. Package outline

SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1

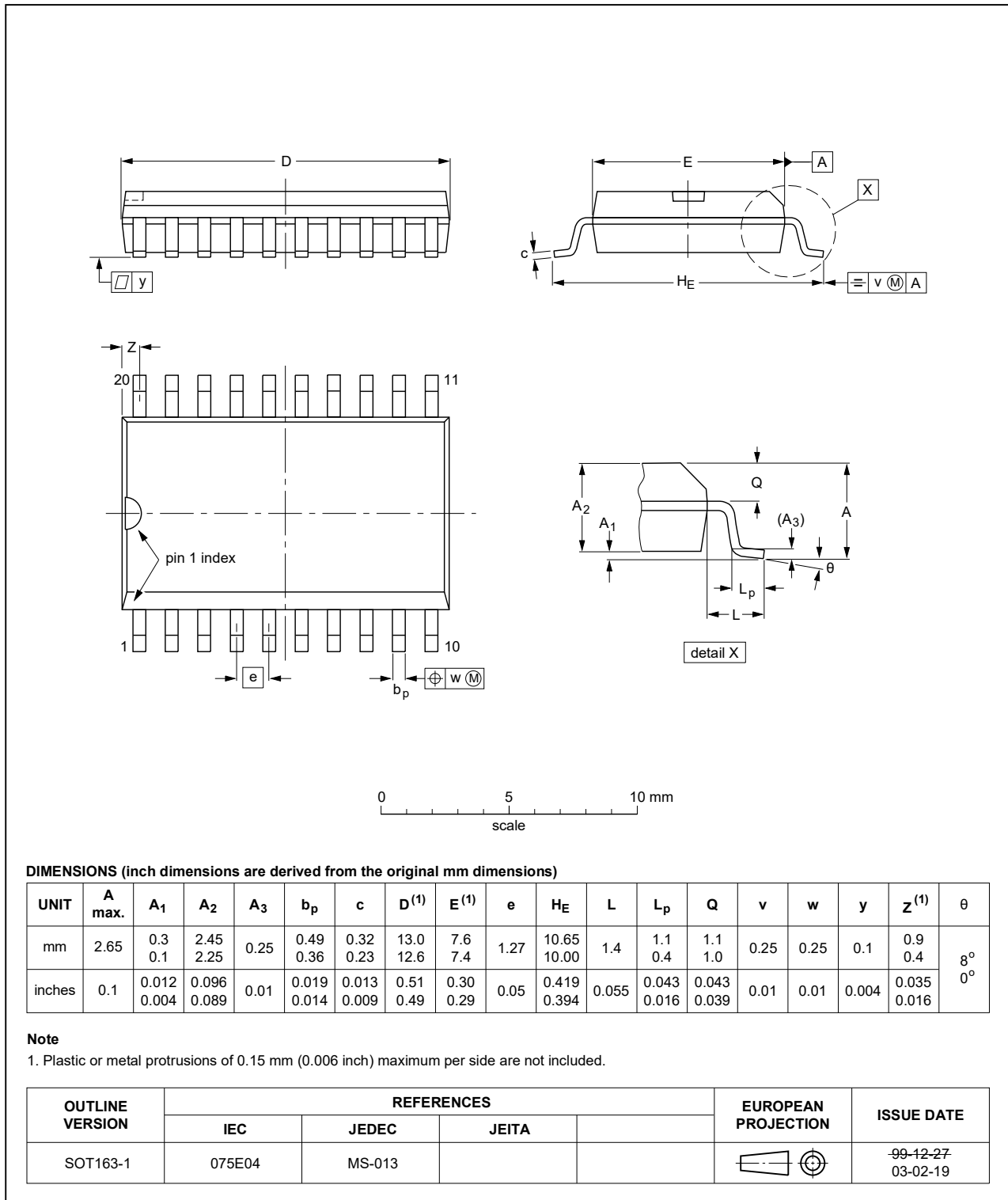


Fig. 9. Package outline SOT163-1 (SO20)

SSOP20: plastic shrink small outline package; 20 leads; body width 5.3 mm

SOT339-1

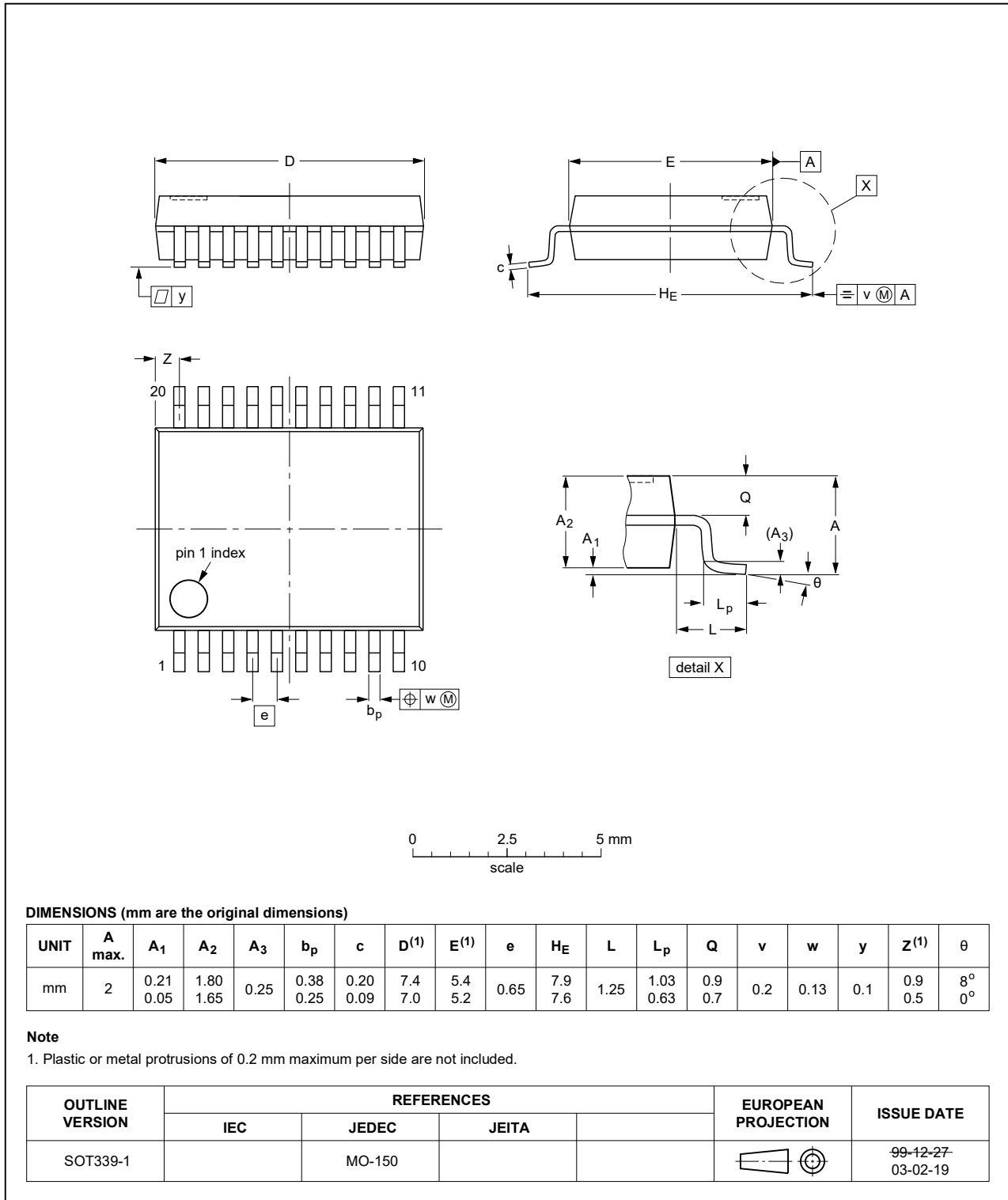


Fig. 10. Package outline SOT339-1 (SSOP20)

TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm

SOT360-1

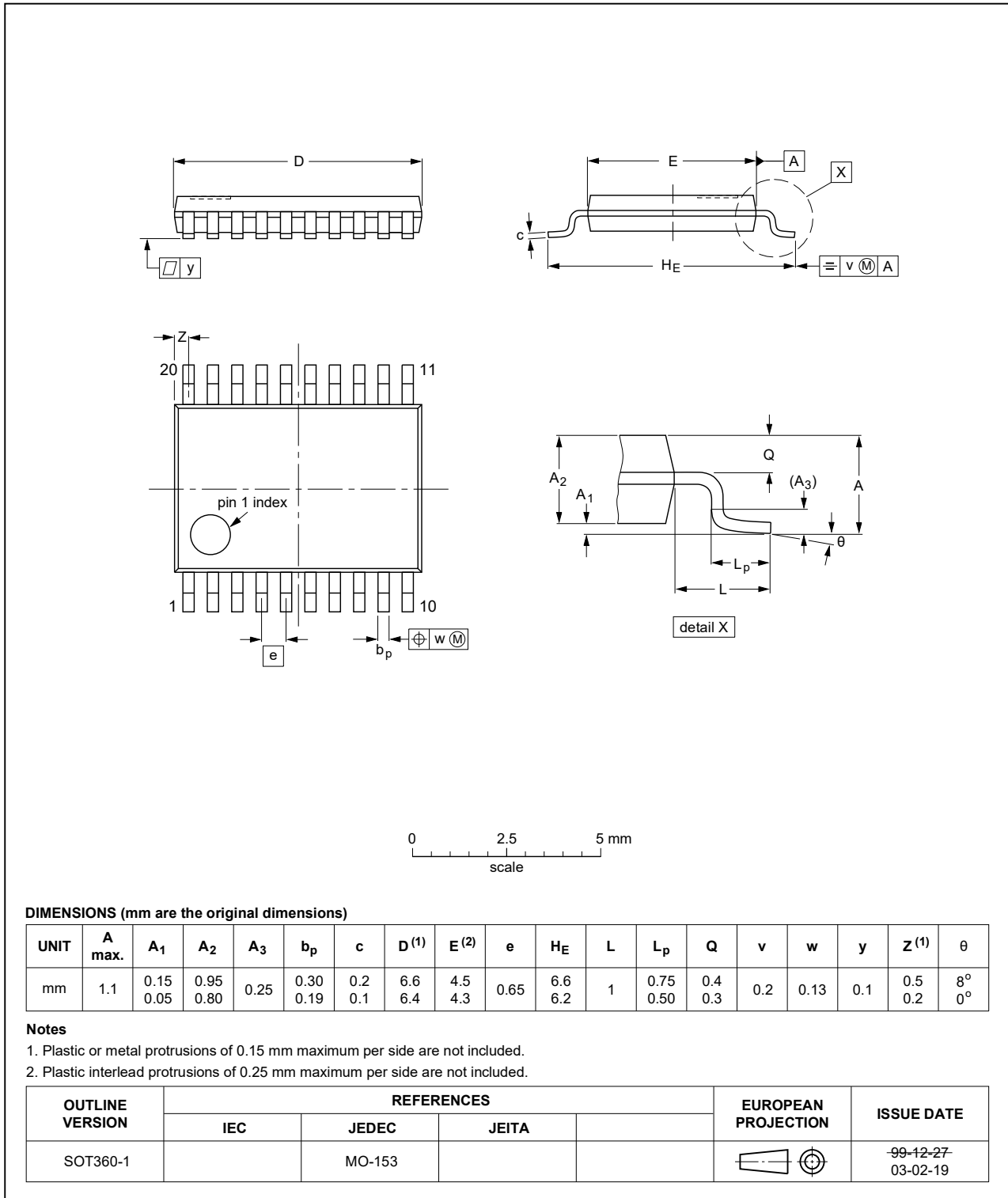


Fig. 11. Package outline SOT360-1 (TSSOP20)

DHVQFN20: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body 2.5 x 4.5 x 0.85 mm

SOT764-1



Fig. 12. Package outline SOT764-1 (DHVQFN20)

## 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
MM	Machine Model
TTL	Transistor-Transistor Logic

## 13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC273 v.7	20200828	Product data sheet	-	74LVC273 v.6
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> updated.</li> <li><a href="#">Table 4</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li> <li><a href="#">Fig. 12</a>: Package outline drawing SOT764-1 (DHVQFN20) updated.</li> </ul>			
74LVC273 v.6	20121231	Product data sheet	-	74LVC273 v.5
Modifications:	<ul style="list-style-type: none"> <li>General description changed (errata).</li> </ul>			
74LVC273 v.5	20121206	Product data sheet	-	74LVC273 v.4
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li><a href="#">Table 4</a>, <a href="#">Table 5</a>, <a href="#">Table 6</a>, <a href="#">Table 7</a>, <a href="#">Table 8</a> and <a href="#">Table 9</a>: values added for lower voltage ranges.</li> </ul>			
74LVC273 v.4	20040312	Product specification	-	74LVC273 v.3
74LVC273 v.3	20031030	Product specification	-	74LVC273 v.2
74LVC273 v.2	19980520	Product specification	-	74LVC273 v.1
74LVC273 v.1	19960606	Product specification	-	-

## 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>.

### Definitions

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## Contents

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<b>1. General description</b> .....	<b>1</b>
<b>2. Features and benefits</b> .....	<b>1</b>
<b>3. Ordering information</b> .....	<b>1</b>
<b>4. Functional diagram</b> .....	<b>2</b>
<b>5. Pinning information</b> .....	<b>2</b>
5.1. Pinning.....	2
5.2. Pin description.....	3
<b>6. Functional description</b> .....	<b>3</b>
<b>7. Limiting values</b> .....	<b>3</b>
<b>8. Recommended operating conditions</b> .....	<b>4</b>
<b>9. Static characteristics</b> .....	<b>4</b>
<b>10. Dynamic characteristics</b> .....	<b>5</b>
10.1. Waveforms and test circuit.....	6
<b>11. Package outline</b> .....	<b>9</b>
<b>12. Abbreviations</b> .....	<b>13</b>
<b>13. Revision history</b> .....	<b>13</b>
<b>14. Legal information</b> .....	<b>14</b>

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