74LVC273

Octal D-type flip-flop with reset; positive-edge trigger Rev. 6 — 31 December 2012 Product of

Product data sheet

1. **General description**

The 74LVC273 has eight edge-triggered, D-type flip-flops with individual Dn inputs and Qn outputs. The common clock (CP) and master reset (MR) inputs load and reset (clear) all flip-flops simultaneously. The state of each Dn input, one set-up time before the LOW-to-HIGH clock transition, is transferred to the corresponding output (Qn) of the flip-flop. All outputs will be forced LOW independently of clock or data inputs by a LOW voltage level on the MR input.

The device is useful for applications where the true output only is required and the clock and master reset are common to all storage elements.

Features and benefits 2.

- Wide supply voltage range from 1.2 V to 3.6 V
- Inputs accept voltages up to 5.5 V
- CMOS low power consumption
- Direct interface with TTL levels
- Output drive capability 50 Ω 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



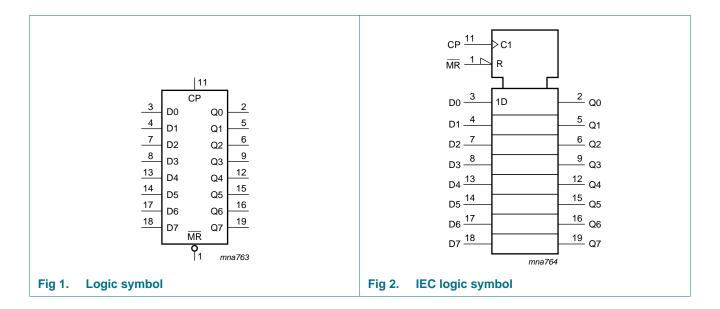
Octal D-type flip-flop with reset; positive-edge trigger

3. Ordering information

Table 1. Ordering information

Type number	Package	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 \times 4.5 \times 0.85 mm	SOT764-1					

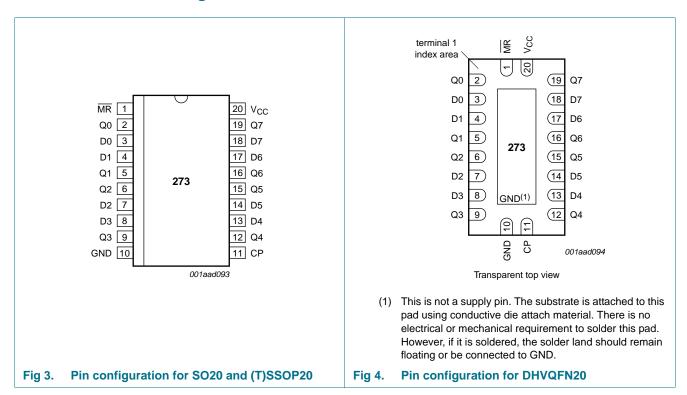
4. Functional diagram



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

5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
MR	1	master reset input (active LOW)
СР	11	clock input (LOW-to-HIGH; edge-triggered)
D[0:7]	3, 4, 7, 8, 13, 14, 17, 18	data input
Q[0:7]	2, 5, 6, 9, 12, 15, 16, 19	flip-flop output
GND	10	ground (0 V)
V _{CC}	20	supply voltage

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6. Functional description

Table 3. Function table[1]

Operating mode	Input	Input				
	MR	СР	Dn	Qn		
Reset (clear)	L	X	X	L		
Load '1'	Н	↑	h	Н		
Load '0'	Н	↑	1	L		

^[1] H = HIGH voltage level

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		-0.5	+6.5	V
I _{IK}	input clamping current	V _I < 0 V	-50	-	mA
V_{I}	input voltage		<u>[1]</u> –0.5	+6.5	V
I _{OK}	output clamping current	$V_O > V_{CC}$ or $V_O < 0 \text{ V}$	-	50	mA
V _O	output voltage		<u>[2]</u> −0.5	$V_{CC} + 0.5$	V
Io	output current	$V_O = 0 V \text{ to } V_{CC}$	-	±50	mA
I _{CC}	supply current		-	100	mA
I_{GND}	ground current		-100	-	mA
T _{stg}	storage temperature		-65	+150	°C
P _{tot}	total power dissipation	$T_{amb} = -40 ^{\circ}\text{C} \text{ to } +125 ^{\circ}\text{C}$	<u>[3]</u> _	500	mW

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

8. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
V_{CC}	supply voltage		1.65	-	3.6	V
		functional	1.2	-	-	V
VI	input voltage		0	-	5.5	V
Vo	output voltage		0	-	V_{CC}	V

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L = LOW voltage level

X = don't care

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

I = LOW voltage level one set-up time prior to the LOW-to-HIGH CP transition

^{↑ =} LOW-to-HIGH clock transition

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

^[3] For SO20 packages: above 70 °C the value of P_{tot} derates linearly with 8 mW/K.
For (T)SSOP20 packages: above 60 °C the value of P_{tot} derates linearly with 5.5 mW/K.
For DHVQFN20 packages: above 60 °C the value of P_{tot} derates linearly with 4.5 mW/K.

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Table 5. Recommended operating conditions ...continued

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
T_{amb}	ambient temperature	in free air	-40	-	+125	°C
$\Delta t/\Delta V$ input transition rise an	input transition rise and fall	$V_{CC} = 1.65 \text{ V to } 2.7 \text{ V}$	0	-	20	ns/V
rate		$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$	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 +8	35 °C	-40 °C to	+125 °C	Unit
			Min	Typ[1]	Max	Min	Max	
V _{IH}	HIGH-level	V _{CC} = 1.2 V	1.08	-	-	1.08	-	V
	input voltage	V _{CC} = 1.65 V to 1.95 V	$0.65 \times V_{CC}$	-	-	$0.65 \times V_{CC}$	-	V
		V _{CC} = 2.3 V to 2.7 V	1.7	-	-	1.7	-	V
		V _{CC} = 2.7 V to 3.6 V	2.0	-	-	2.0	-	V
V_{IL}	LOW-level	V _{CC} = 1.2 V	-	-	0.12	-	0.12	V
	input voltage	V _{CC} = 1.65 V to 1.95 V	-	-	$0.35 \times V_{CC}$	-	$0.35 \times V_{CC}$	V
		V _{CC} = 2.3 V to 2.7 V	-	-	0.7	-	0.7	V
		V _{CC} = 2.7 V to 3.6 V	-	-	0.8	-	0.8	V
V _{OH}	HIGH-level	$V_I = V_{IH}$ or V_{IL}						
	output voltage	$I_O = -100 \mu A;$ $V_{CC} = 1.65 \text{ V to } 3.6 \text{ V}$	V _{CC} – 0.2	-	-	V _{CC} - 0.3	-	V
		$I_O = -4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	1.2	-	-	1.05	-	V
		$I_{O} = -8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	1.8	-	-	1.65	-	V
		$I_O = -12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	2.2	-	-	2.05	-	V
		$I_O = -18 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.4	-	-	2.25	-	V
		$I_{O} = -24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.2	-	-	2.0	-	V
V_{OL}	LOW-level	$V_I = V_{IH}$ or V_{IL}						
	output voltage	$I_O = 100 \mu A;$ $V_{CC} = 1.65 \text{ V to } 3.6 \text{ V}$	-	-	0.2	-	0.3	V
		$I_O = 4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	-	-	0.45	-	0.65	V
		$I_O = 8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	-	-	0.6	-	0.8	V
		$I_{O} = 12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	-	-	0.4	-	0.6	V
		$I_O = 24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.55	-	0.8	V
l _l	input leakage current	$V_{CC} = 3.6 \text{ V}; V_{I} = 5.5 \text{ V or GND}$	-	±0.1	±5	-	±20	μΑ
I _{CC}	supply current	V_{CC} = 3.6 V; V_I = V_{CC} or GND; I_O = 0 A	-	0.1	10	-	40	μА
Δl _{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	μА
Cı	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 V (unless stated otherwise) and T_{amb} = 25 °C.

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

10. Dynamic characteristics

Table 7. Dynamic characteristics

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

Symbol	Parameter	Conditions		-40	°C to +8	5 °C	-40 °C to +125 °C		Unit
				Min	Typ[1]	Max	Min	Max	
t _{pd}	propagation	CP to Qn; see Figure 5	[2]						
	delay	V _{CC} = 1.2 V		-	18	-	-	-	ns
		V _{CC} = 1.65 V to 1.95 V		2.5	9.7	19.2	2.5	22.2	ns
		V _{CC} = 2.3 V to 2.7 V		1.8	4.9	9.9	1.8	11.4	ns
		V _{CC} = 2.7 V		1.5	4.5	8.4	1.5	10.5	ns
		V _{CC} = 3.0 V to 3.6 V		1.5	4.1	8.2	1.5	10.5	ns
t _{PHL}	HIGH to LOW	MR to Qn; see Figure 6							
	propagation	V _{CC} = 1.2 V		-	18	-	-	-	ns
	delay	V _{CC} = 1.65 V to 1.95 V		2.4	10.2	20.4	2.4	23.5	ns
		V _{CC} = 2.3 V to 2.7 V		1.7	5.2	10.5	1.7	12.1	ns
		V _{CC} = 2.7 V		1.5	4.7	8.9	1.5	11.5	ns
		V _{CC} = 3.0 V to 3.6 V		1.5	4.3	8.7	1.5	11.0	ns
t _W	pulse width	clock HIGH or LOW; see Figure 5							
		V _{CC} = 1.65 V to 1.95 V		6.0	-	-	6.0	-	ns
		V _{CC} = 2.3 V to 2.7 V		5.0	-	-	5.0	-	ns
		V _{CC} = 2.7 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 Figure 6							
		V _{CC} = 1.65 V to 1.95 V		6.0	-	-	6.0	-	ns
		V _{CC} = 2.3 V to 2.7 V		5.0	-	-	5.0	-	ns
		V _{CC} = 2.7 V		5.0	1.7	-	5.0	-	ns
		V _{CC} = 3.0 V to 3.6 V		4.0	1.2	-	4.0	-	ns
t _{rec}	recovery time	MR to CP; see Figure 6							
		V _{CC} = 1.65 V to 1.95 V		2.0	-	-	2.0	-	ns
		V _{CC} = 2.3 V to 2.7 V		2.0	-	-	2.0	-	ns
		V _{CC} = 2.7 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
t _{su}	set-up time	Dn to CP; see Figure 7							
		V _{CC} = 1.65 V to 1.95 V		5.0	-	-	5.0	-	ns
		V _{CC} = 2.3 V to 2.7 V		3.5	-	-	3.5	-	ns
		V _{CC} = 2.7 V		3.0	1.0	-	3.0	-	ns
		V _{CC} = 3.0 V to 3.6 V		1.0	0.0	-	1.0	-	ns
t _h	hold time	Dn to CP; see Figure 7							
		V _{CC} = 1.65 V to 1.95 V		3.0	-	-	3.0	-	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		2.5	-	-	2.5	-	ns
		V _{CC} = 2.7 V		2.0	-0.2	-	2.0	-	ns
		V _{CC} = 3.0 V to 3.6 V		1.0	0.0	_	1.0		ns

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

 Table 7.
 Dynamic characteristics ...continued

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

Symbol	Parameter	Conditions		-40 °C to +85 °C			–40 °C to +125 °C		Unit
				Min	Typ[1]	Max	Min	Max	
f _{max}	maximum	see Figure 5							
	frequency	V _{CC} = 1.65 V to 1.95 V		80	-	-	64	-	MHz
	$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		100	-	-	80	-	MHz	
		V _{CC} = 2.7 V		150	-	-	150	-	MHz
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$		150	230	-	150	-	MHz
t _{sk(o)}	output skew time	$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	[3]	-	-	1.0	-	1.5	ns
C_{PD}	power dissipation	per flip-flop; $V_I = GND$ to V_{CC}	<u>[4]</u>						
	capacitance	$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$		-	14.0	-	-	-	pF
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		-	17.7	-	-	-	pF
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$		-	21.0	-	-	-	pF

^[1] Typical values are measured at $T_{amb} = 25$ °C and $V_{CC} = 1.2$ V, 1.8 V, 2.5 V, 2.7 V and 3.3 V respectively.

[4] 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

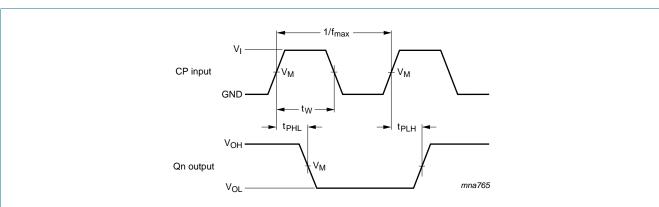
C_L = output load capacitance in pF

V_{CC} = supply voltage in Volt

N = number of inputs switching

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

11. Waveforms



Measurement points are given in Table 8.

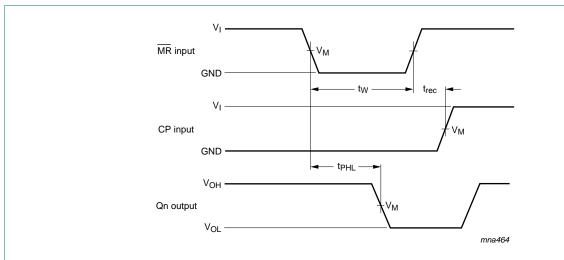
 V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig 5. Clock (CP) to output (Qn) propagation delays, the clock pulse width, and the maximum frequency

^[2] t_{pd} is the same as t_{PLH} and t_{PHL} .

^[3] Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.

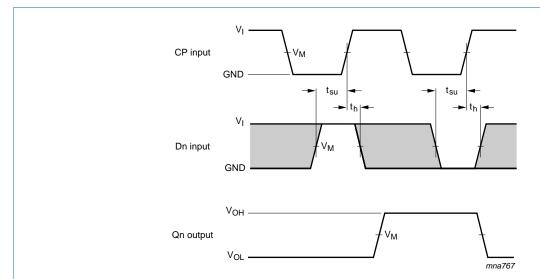
Octal D-type flip-flop with reset; positive-edge trigger



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 (MR) pulse width, the master reset to output (Qn) propagation delays, and the master reset to clock (CP) recovery time



Measurement points are given in Table 8.

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

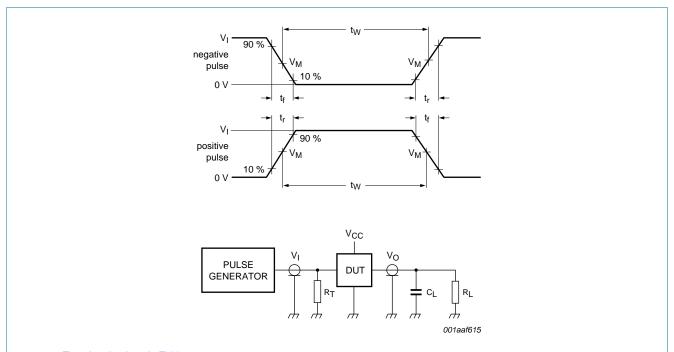
The shaded areas indicate when the input is permitted to change for predictable output performance.

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

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

Table 8. Measurement points

Supply voltage	Input		Output	Output			
V _{CC}	VI	V _M	V _M	V _X	V _Y		
1.2 V	V_{CC}	$0.5 \times V_{CC}$	$0.5 \times V_{\text{CC}}$	V _{OL} + 0.15 V	$V_{OH} - 0.15 V$		
1.65 V to 1.95 V	V_{CC}	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	V _{OL} + 0.15 V	V _{OH} – 0.15 V		
2.3 V to 2.7 V	V_{CC}	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	V _{OL} + 0.15 V	V _{OH} – 0.15 V		
2.7 V	2.7 V	1.5 V	1.5 V	V _{OL} + 0.3 V	$V_{OH} - 0.3 V$		
3.0 V to 3.6 V	2.7 V	1.5 V	1.5 V	$V_{OL} + 0.3 V$	$V_{OH} - 0.3 V$		



Test data is given in Table 9.

Definitions for test circuit:

R_L = Load resistance.

 $\ensuremath{C_L}$ = Load capacitance including jig and probe capacitance.

 R_T = Termination resistance should be equal to output impedance Z_0 of the pulse generator.

Fig 8. Load circuitry for switching times

Table 9. Test data

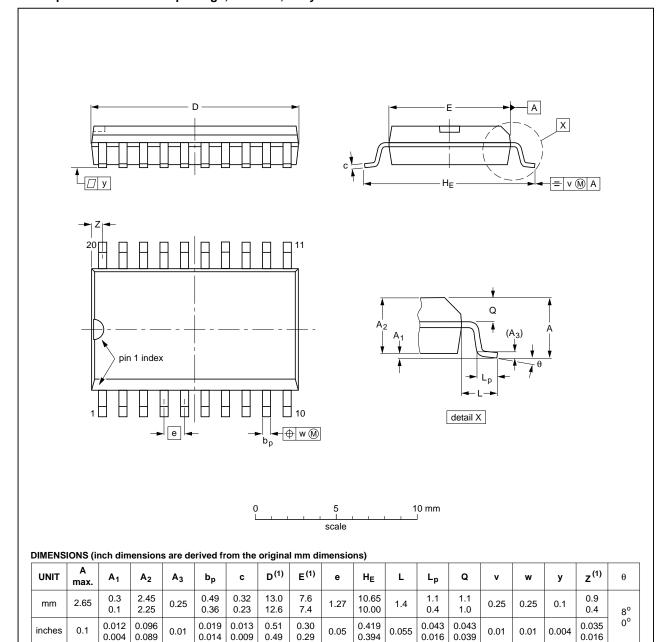
Supply voltage Input			Load	Load		V _{EXT}		
V _{CC}	VI	t _r , t _f	CL	R _L	t _{PLH} , t _{PHL}	t_{PLZ}, t_{PZL}	t _{PHZ} , t _{PZH}	
1.2 V	V_{CC}	≤ 2 ns	30 pF	1 k Ω	open	$2\times V_{CC}$	GND	
1.65 V to 1.95 V	V_{CC}	≤ 2 ns	30 pF	1 kΩ	open	$2\times V_{CC}$	GND	
2.3 V to 2.7 V	V_{CC}	≤ 2 ns	30 pF	500Ω	open	$2\times V_{CC}$	GND	
2.7 V	2.7 V	≤ 2.5 ns	50 pF	500Ω	open	$2\times V_{CC}$	GND	
3.0 V to 3.6 V	2.7 V	≤ 2.5 ns	50 pF	500Ω	open	$2\times V_{CC}$	GND	

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

12. Package outline

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

SOT163-1



Note

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

OUTLINE		REFER	EUROPEAN	IOOUE DATE			
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE	
SOT163-1	075E04	MS-013				99-12-27 03-02-19	

Fig 9. Package outline SOT163-1 (SO20)

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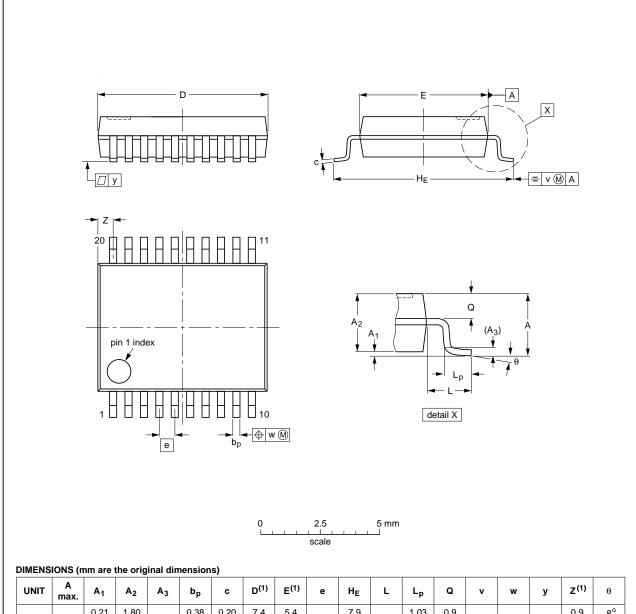
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74LVC273 **NXP Semiconductors**

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

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

SOT339-1



UNIT	A max.	A ₁	A ₂	A ₃	bp	С	D ⁽¹⁾	E ⁽¹⁾	e	HE	L	Lp	Q	v	w	у	Z ⁽¹⁾	θ
mm	2	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	7.4 7.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	0.9 0.5	8° 0°

Note

1. Plastic or metal protrusions of 0.2 mm maximum per side are not included.

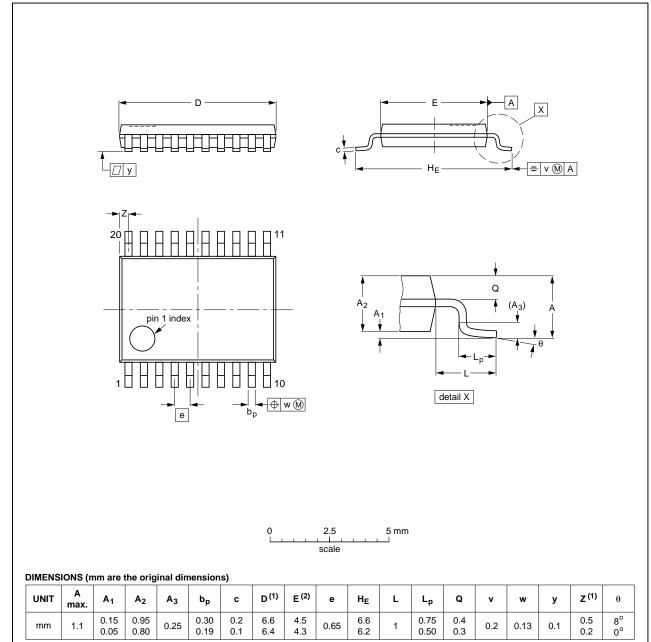
OUTLINE		REFER	EUROPEAN	ISSUE DATE		
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE
SOT339-1		MO-150				99-12-27 03-02-19
					'	***************************************

Fig 10. Package outline SOT339-1 (SSOP20)

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

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

SOT360-1



Notes

- 1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
- 2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

OUTLINE		REFERENCES				ISSUE DATE	
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE	
SOT360-1		MO-153				99-12-27 03-02-19	
•							

Fig 11. Package outline SOT360-1 (TSSOP20)

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

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

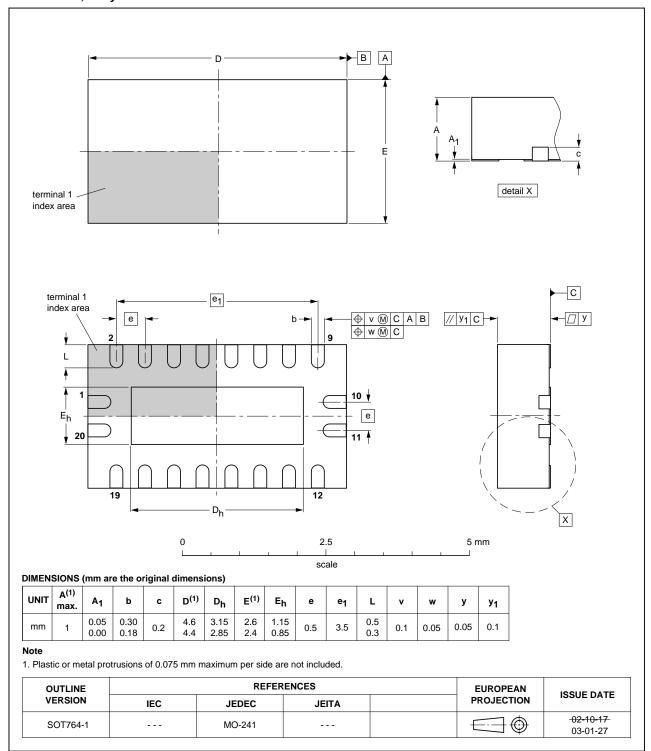


Fig 12. Package outline SOT764-1 (DHVQFN20)

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

13. Abbreviations

Table 10. Abbreviations

Acronym	Description
CDM	Charged Device Model
DUT	Device Under Test
ESD	ElectroStatic Discharge
НВМ	Human Body Model
MM	Machine Model
TTL	Transistor-Transistor Logic

14. Revision history

Table 11. Revision history

	•					
Document ID	Release date	Data sheet status	Change notice	Supersedes		
74LVC273 v.6	20121231	Product data sheet	-	74LVC273 v.5		
Modifications:	 General descr 	iption changed (errata).				
74LVC273 v.5	20121206	Product data sheet	-	74LVC273 v.4		
Modifications:	 The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. 					
	 Legal texts have 	ve been adapted to the new	company name where	appropriate.		
	• Table 4, Table	5, Table 6, Table 7, Table 8	and <u>Table 9</u> : values ad	ded for lower voltage ranges.		
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	-	-		

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15. Legal information

15.1 Data sheet status

Document status[1][2]	Product status[3]	Definition
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Octal D-type flip-flop with reset; positive-edge trigger

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

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