

# DATA SHEET

## **74LV374**

**Octal D-type flip-flop;  
positive edge-trigger (3-State)**

Product specification  
Supersedes data of 1996 Feb  
IC24 Data Handbook

1997 Mar 20

## Octal D-type flip-flop; positive edge-trigger (3-State)

74LV374

## FEATURES

- Wide operating voltage: 1.0 to 5.5V
- Optimized for Low Voltage applications: 1.0 to 3.6V
- Accepts TTL input levels between  $V_{CC} = 2.7V$  and  $V_{CC} = 3.6V$
- Typical  $V_{OLP}$  (output ground bounce)  $< 0.8V$  @  $V_{CC} = 3.3V$ ,  $T_{amb} = 25^{\circ}C$
- Typical  $V_{OHV}$  (output  $V_{OH}$  undershoot)  $> 2V$  @  $V_{CC} = 3.3V$ ,  $T_{amb} = 25^{\circ}C$
- Common 3-State output enable input
- Output capability: bus driver
- $I_{CC}$  category: MSI

## DESCRIPTION

The 74LV374 is a low-voltage Si-gate CMOS device and is pin and function compatible with 74HC/HCT374.

The 74LV374 is an octal D-type flip-flop featuring separate D-type inputs for each flip-flop and 3-state outputs for bus oriented applications. A clock (CP) and an output enable ( $\overline{OE}$ ) input are common to all flip-flops.

The eight flip-flops will store the state of their individual D-inputs that meet the set-up and hold times requirements on the LOW-to-HIGH CP transition.

When  $\overline{OE}$  is LOW, the contents of the eight flip-flops is available at the outputs. When  $\overline{OE}$  is HIGH, the outputs go to the high impedance OFF-state. Operation of the  $\overline{OE}$  input does not affect the state of the flip-flops.

## QUICK REFERENCE DATA

$GND = 0V$ ;  $T_{amb} = 25^{\circ}C$ ;  $t_r = t_f \leq 2.5$  ns

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT
$t_{PHL}/t_{PLH}$	Propagation delay CP to $Q_n$	$C_L = 15pF$ $V_{CC} = 3.3V$	14	ns
$f_{max}$	Maximum clock frequency		77	MHz
$C_I$	Input capacitance		3.5	pF
$C_{PD}$	Power dissipation capacitance per flip-flop	Notes 1 and 2	25	pF

## NOTES:

- $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu W$ )  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$  where:  
 $f_i$  = input frequency in MHz;  $C_L$  = output load capacity in pF;  
 $f_o$  = output frequency in MHz;  $V_{CC}$  = supply voltage in V;  
 $\sum (C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs.
- The condition is  $V_I = GND$  to  $V_{CC}$

## ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	PKG. DWG. #
20-Pin Plastic DIL	$-40^{\circ}C$ to $+125^{\circ}C$	74LV374 N	74LV374 N	SOT146-1
20-Pin Plastic SO	$-40^{\circ}C$ to $+125^{\circ}C$	74LV374 D	74LV374 D	SOT163-1
20-Pin Plastic SSOP Type II	$-40^{\circ}C$ to $+125^{\circ}C$	74LV374 DB	74LV374 DB	SOT339-1

## PIN DESCRIPTION

PIN NUMBER	SYMBOL	FUNCTION
1	$\overline{OE}$	Output enable input (active-LOW)
2, 5, 6, 9, 12, 15, 16, 19	Q0 to Q7	3-State flip-flop outputs
3, 4, 7, 8, 13, 14, 17, 18	D0 to D7	Data inputs
10	GND	Ground (0V)
11	CP	Clock input (LOW-to-HIGH, edge-triggered)
20	$V_{CC}$	Positive supply voltage

## FUNCTION TABLE

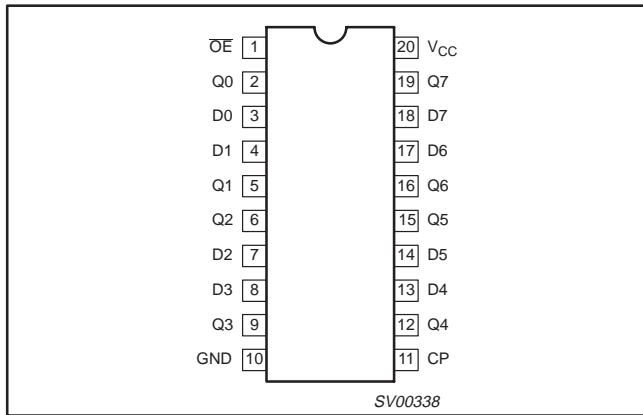
OPERATING MODES	INPUTS			INTERNAL FLIP-FLOPS	OUTPUTS Q0 to Q7
	$\overline{OE}$	CP	$D_n$		
Load and read register	L	$\uparrow$	l	L	L
	L	$\uparrow$	h	H	H
Load register and disable outputs	H	$\uparrow$	l	L	Z
	H	$\uparrow$	h	H	Z

- 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  
Z = High impedance OFF-state  
 $\uparrow$  = LOW-to-HIGH clock transition

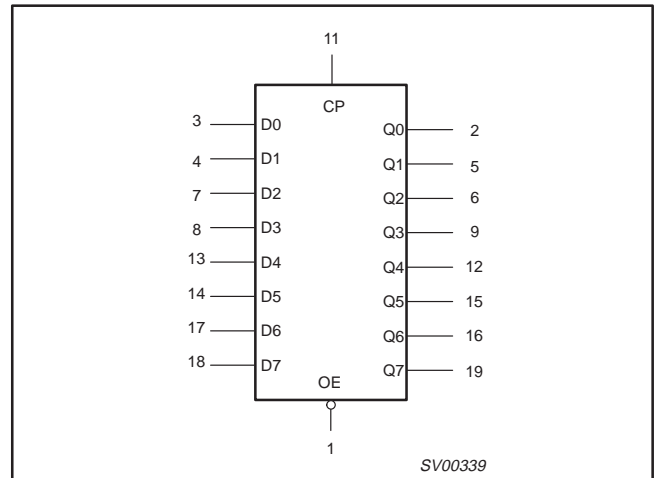
# Octal D-type flip-flop; positive edge-trigger (3-State)

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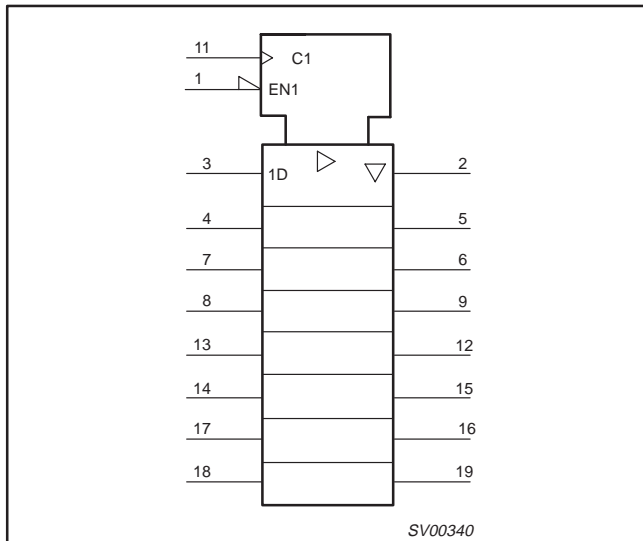
### PIN CONFIGURATION



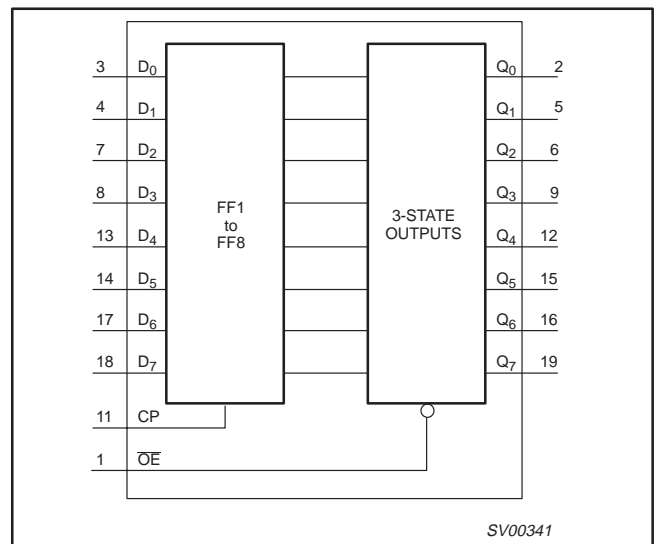
### LOGIC SYMBOL



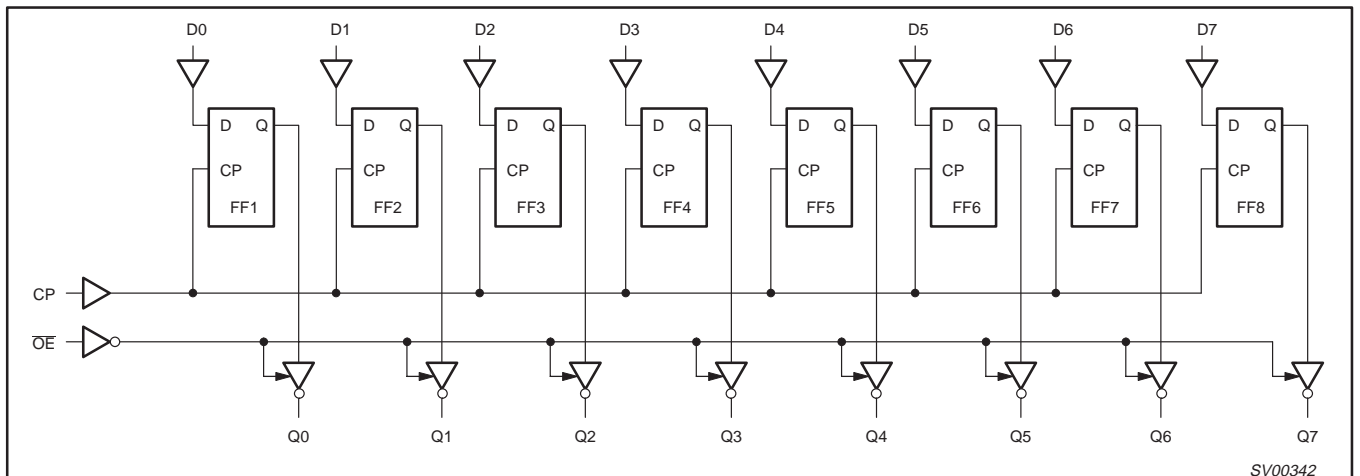
### LOGIC SYMBOL (IEEE/IEC)



### FUNCTIONAL DIAGRAM



### LOGIC DIAGRAM



## Octal D-type flip-flop; positive edge-trigger (3-State)

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**ABSOLUTE MAXIMUM RATINGS<sup>1, 2</sup>**

In accordance with the Absolute Maximum Rating System (IEC 134)

Voltages are referenced to GND (ground = 0V)

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
$V_{CC}$	DC supply voltage		-0.5 to +7.0	V
$\pm I_{IK}$	DC input diode current	$V_I < -0.5$ or $V_I > V_{CC} + 0.5V$	20	mA
$\pm I_{OK}$	DC output diode current	$V_O < -0.5$ or $V_O > V_{CC} + 0.5V$	50	mA
$\pm I_O$	DC output source or sink current – standard outputs – bus driver outputs	$-0.5V < V_O < V_{CC} + 0.5V$	25 35	mA
$\pm I_{GND}$ , $\pm I_{CC}$	DC $V_{CC}$ or GND current for types with –standard outputs –bus driver outputs		50 70	mA
$T_{stg}$	Storage temperature range		-65 to +150	°C
$P_{TOT}$	Power dissipation per package –plastic DIL –plastic mini-pack (SO) –plastic shrink mini-pack (SSOP and TSSOP)	for temperature range: -40 to +125°C above +70°C derate linearly with 12mW/K above +70°C derate linearly with 8 mW/K above +60°C derate linearly with 5.5 mW/K	750 500 400	mW

**NOTES:**

- Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

**RECOMMENDED OPERATING CONDITIONS**

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP.	MAX	UNIT
$V_{CC}$	DC supply voltage	See Note1	1.0	3.3	5.5	V
$V_I$	Input voltage		0	–	$V_{CC}$	V
$V_O$	Output voltage		0	–	$V_{CC}$	V
$T_{amb}$	Operating ambient temperature range in free air	See DC and AC characteristics per device	-40 -40		+85 +125	°C
$t_r, t_f$	Input rise and fall times except for Schmitt-trigger inputs	$V_{CC} = 1.0V$ to $2.0V$ $V_{CC} = 2.0V$ to $2.7V$ $V_{CC} = 2.7V$ to $3.6V$ $V_{CC} = 3.6V$ to $5.5V$	– – – –	– – – –	500 200 100 50	ns/V

**NOTES:**

- The LV is guaranteed to function down to  $V_{CC} = 1.0V$  (input levels GND or  $V_{CC}$ ); DC characteristics are guaranteed from  $V_{CC} = 1.2V$  to  $V_{CC} = 5.5V$ .

## Octal D-type flip-flop; positive edge-trigger (3-State)

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**DC CHARACTERISTICS FOR THE LV FAMILY**

Over recommended operating conditions voltages are referenced to GND (ground = 0V)

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS					UNIT
			-40°C to +85°C			-40°C to +125°C		
			MIN	TYP <sup>1</sup>	MAX	MIN	MAX	
V <sub>IH</sub>	HIGH level Input voltage	V <sub>CC</sub> = 1.2V	0.9			0.9		V
		V <sub>CC</sub> = 2.0V	1.4			1.4		
		V <sub>CC</sub> = 2.7 to 3.6V	2.0			2.0		
		V <sub>CC</sub> = 4.5 to 5.5V	0.7*V <sub>CC</sub>			0.7*V <sub>CC</sub>		
V <sub>IL</sub>	LOW level Input voltage	V <sub>CC</sub> = 1.2V			0.3	0.3	V	
		V <sub>CC</sub> = 2.0V			0.6	0.6		
		V <sub>CC</sub> = 2.7 to 3.6V			0.8	0.8		
		V <sub>CC</sub> = 4.5 to 5.5		0.3*V <sub>CC</sub>		0.3*V <sub>CC</sub>		
V <sub>OH</sub>	HIGH level output voltage; all outputs	V <sub>CC</sub> = 1.2V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; -I <sub>O</sub> = 100µA		1.2			V	
		V <sub>CC</sub> = 2.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; -I <sub>O</sub> = 100µA	1.8	2.0		1.8		
		V <sub>CC</sub> = 2.7V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; -I <sub>O</sub> = 100µA	2.5	2.7		2.5		
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; -I <sub>O</sub> = 100µA	2.8	3.0		2.8		
		V <sub>CC</sub> = 4.5V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; -I <sub>O</sub> = 100µA	4.3	4.5		4.3		
V <sub>OH</sub>	HIGH level output voltage; STANDARD outputs	V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; -I <sub>O</sub> = 6mA	2.40	2.82		2.20	V	
		V <sub>CC</sub> = 4.5V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; -I <sub>O</sub> = 12mA	3.60	4.20		3.50		
V <sub>OH</sub>	HIGH level output voltage; BUS driver outputs	V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; -I <sub>O</sub> = 8mA	2.40	2.82		2.20	V	
		V <sub>CC</sub> = 4.5V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; -I <sub>O</sub> = 16mA	3.60	4.20		3.50		
V <sub>OL</sub>	LOW level output voltage; all outputs	V <sub>CC</sub> = 1.2V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 100µA		0			V	
		V <sub>CC</sub> = 2.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 100µA		0	0.2	0.2		
		V <sub>CC</sub> = 2.7V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 100µA		0	0.2	0.2		
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 100µA		0	0.2	0.2		
		V <sub>CC</sub> = 4.5V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 100µA		0	0.2	0.2		
V <sub>OL</sub>	LOW level output voltage; STANDARD outputs	V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 6mA		0.25	0.40	0.50	V	
		V <sub>CC</sub> = 4.5V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 12mA		0.35	0.55	0.65		
V <sub>OL</sub>	LOW level output voltage; BUS driver outputs	V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 8mA		0.20	0.40	0.50	V	
		V <sub>CC</sub> = 4.5V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 16mA		0.35	0.55	0.65		
I <sub>I</sub>	Input leakage current	V <sub>CC</sub> = 5.5V; V <sub>I</sub> = V <sub>CC</sub> or GND			1.0	1.0	µA	
I <sub>OZ</sub>	3-State output OFF-state current	V <sub>CC</sub> = 5.5V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND			5	10	µA	
I <sub>CC</sub>	Quiescent supply current; SSI	V <sub>CC</sub> = 5.5V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0			20.0	40	µA	
	Quiescent supply current; flip-flops	V <sub>CC</sub> = 5.5V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0			20.0	80		
I <sub>CC</sub>	Quiescent supply current; MSI	V <sub>CC</sub> = 5.5V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0			20.0	160	µA	
	Quiescent supply current; LSI	V <sub>CC</sub> = 5.5V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0			500	1000		
ΔI <sub>CC</sub>	Additional quiescent supply current per input	V <sub>CC</sub> = 2.7V to 3.6V; V <sub>I</sub> = V <sub>CC</sub> - 0.6V			500	850	µA	

**NOTE:**1. All typical values are measured at T<sub>amb</sub> = 25°C.

## Octal D-type flip-flop; positive edge-trigger (3-State)

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**AC CHARACTERISTICS**GND = 0V;  $t_r = t_f = 2.5\text{ns}$ ;  $C_L = 50\text{pF}$ ;  $R_L = 500\Omega$ 

SYMBOL	PARAMETER	WAVEFORM	CONDITION	LIMITS -40 to +85 °C			LIMITS -40 to +125 °C		UNIT
				MIN	TYP	MAX	MIN	MAX	
$t_{\text{PHL}}/t_{\text{PLH}}$	Propagation delay CP to Qn	Figure 1	1.2	–	90	–	–	–	ns
			2.0	–	31	39	–	49	
			2.7	–	23	29	–	36	
			3.0 to 3.6	–	17 <sup>2</sup>	23	–	29	
			4.5 to 5.5	–	–	19	–	24	
$t_{\text{PZH}}/t_{\text{PZL}}$	Propagation delay OE to Qn	Figure 2	1.2	–	75	–	–	–	ns
			2.0	–	26	34	–	43	
			2.7	–	19	25	–	31	
			3.0 to 3.6	–	14 <sup>2</sup>	20	–	25	
			4.5 to 5.5	–	–	17	–	21	
$t_{\text{PHZ}}/t_{\text{PLZ}}$	Propagation delay OE to Qn	Figure 2	1.2	–	80	–	–	–	ns
			2.0	–	29	39	–	48	
			2.7	–	22	29	–	36	
			3.0 to 3.6	–	17 <sup>2</sup>	24	–	29	
			4.5 to 5.5	–	–	20	–	24	
$t_w$	Clock pulse width HIGH or LOW	Figure 1	2.0	34	12	–	41	–	ns
			2.7	25	9	–	30	–	
			3.0 to 3.6	20	7 <sup>2</sup>	–	24	–	
$t_{\text{su}}$	Set-up time Dn to CP	Figure 3	1.2	–	25	–	–	–	ns
			2.0	22	9	–	26	–	
			2.7	16	6	–	19	–	
			3.0 to 3.6	13	5 <sup>2</sup>	–	15	–	
$t_h$	Hold time Dn to CP	Figure 3	1.2	–	-10	–	–	–	ns
			2.0	5	-3	–	5	–	
			2.7	5	-2	–	5	–	
			3.0 to 3.6	5	-2 <sup>2</sup>	–	5	–	
$f_{\text{max}}$	Maximum clock pulse frequency	Figure 2	2.0	15	40	–	12	–	MHz
			2.7	19	58	–	16	–	
			3.0 to 3.6	24	70 <sup>2</sup>	–	20	–	

**NOTE:**

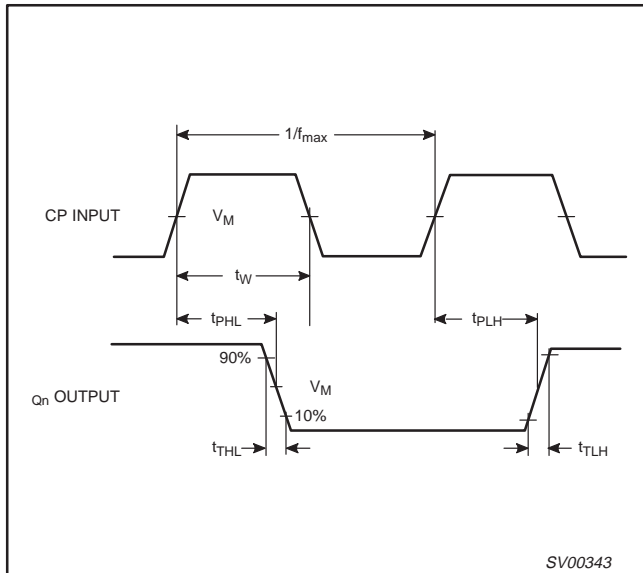
1. Unless otherwise stated, all typical values are at  $T_{\text{amb}} = 25^\circ\text{C}$ .
2. Typical value measured at  $V_{\text{CC}} = 3.3\text{V}$ .
3. Typical value measured at  $V_{\text{CC}} = 5.0\text{V}$ .

# Octal D-type flip-flop; positive edge-trigger (3-State)

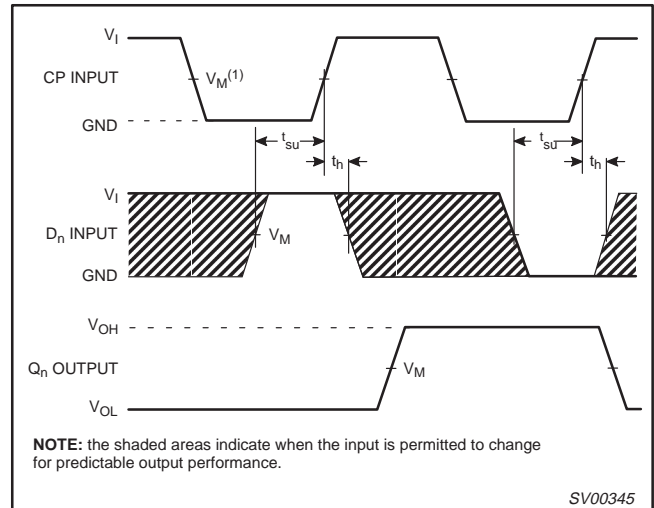
74LV374

## AC WAVEFORMS

$V_M = 1.5V$  at  $V_{CC} \geq 2.7V \leq 3.6V$   
 $V_M = 0.5V * V_{CC}$  at  $V_{CC} < 2.7V$  and  $\geq 4.5V$   
 $V_{OL}$  and  $V_{OH}$  are the typical output voltage drop that occur with the output load.

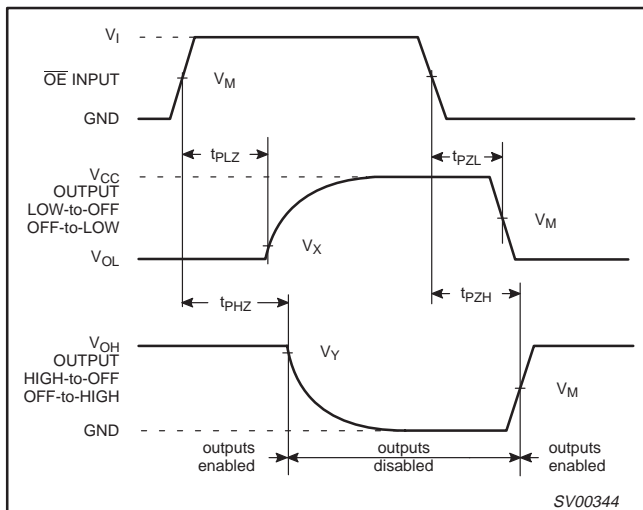


**Figure 1. Waveforms showing the clock (CP) to output (Qn) propagation delays, the clock pulse width, output transition times and the maximum clock pulse frequency**



**Figure 3. Waveforms showing the data set-up and hold times for the Dn input to the CP input**

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



**Figure 2. Waveforms showing the 3-state enable and disable times**

# Octal D-type flip-flop; positive edge-trigger (3-State)

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## TEST CIRCUIT

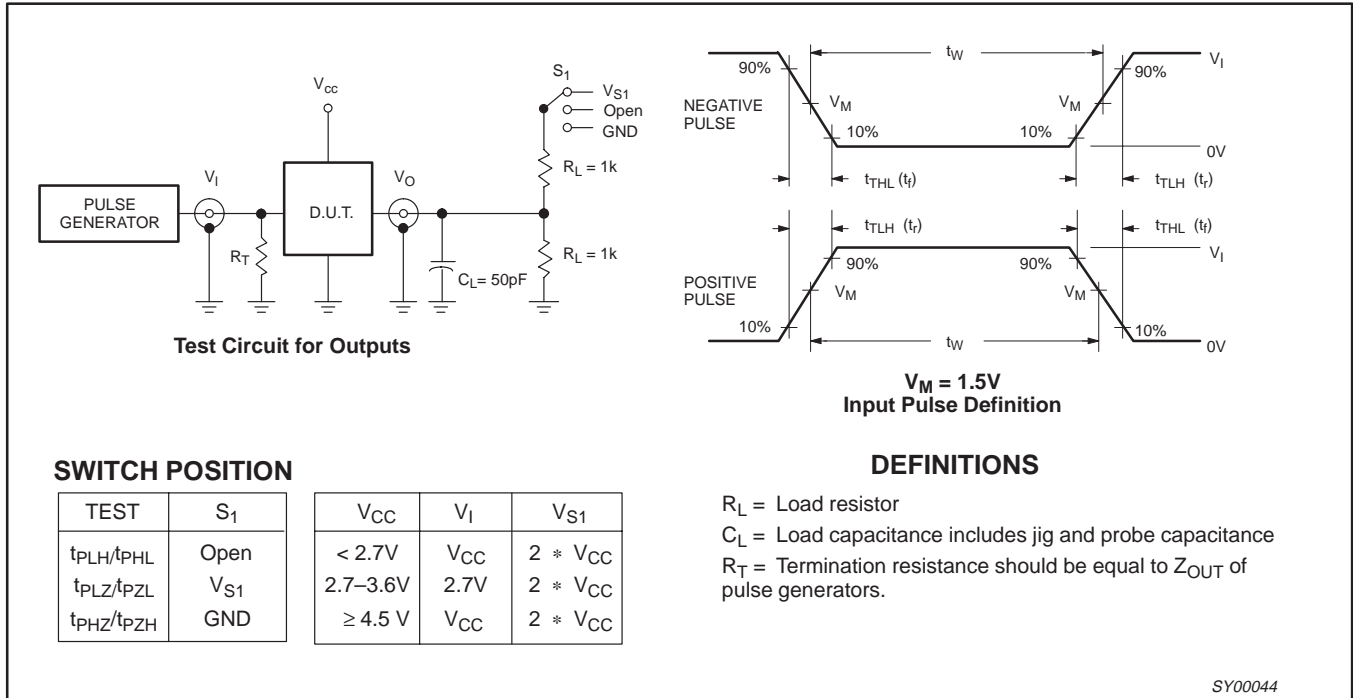


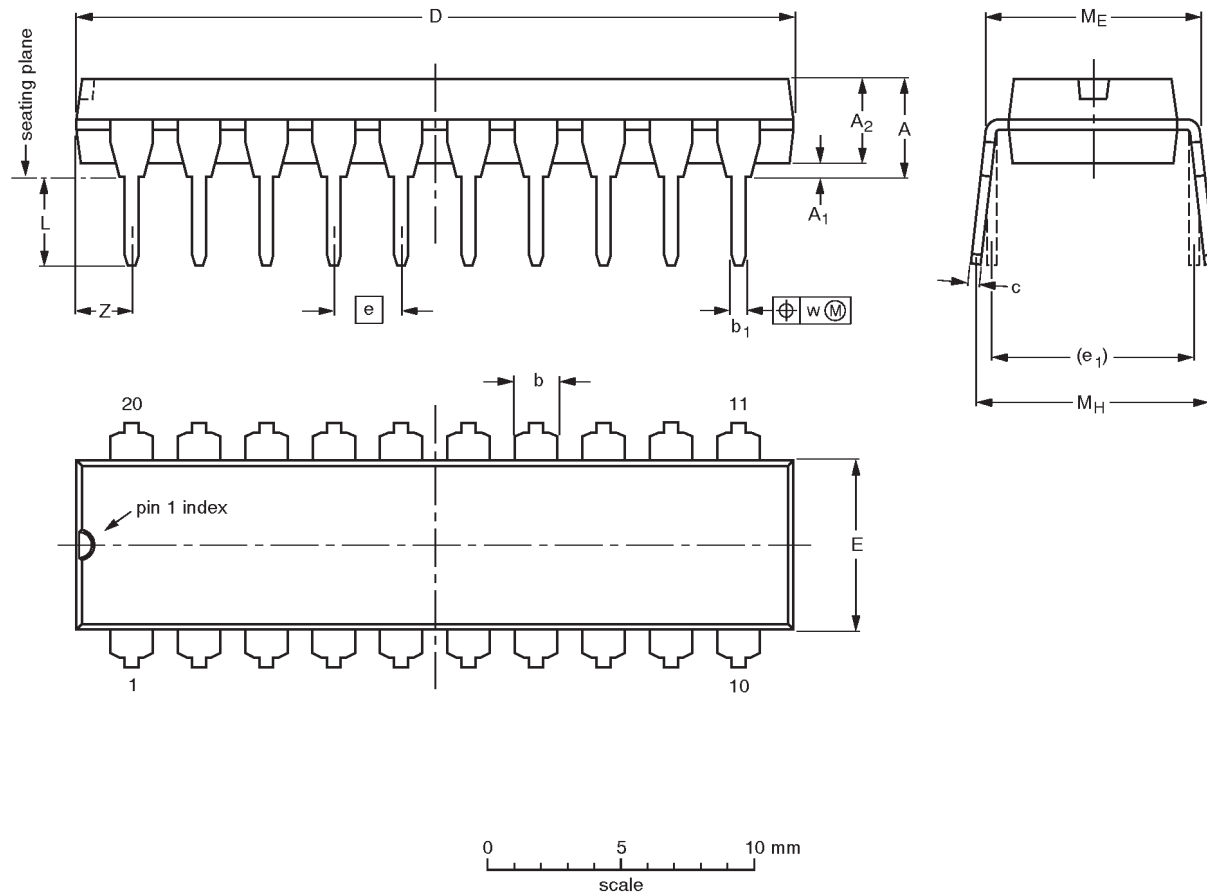
Figure 4. Load circuitry for switching times

# Octal D-type flip-flop; positive edge-trigger (3-State)

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DIP20: plastic dual in-line package; 20 leads (300 mil)

SOT146-1



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

UNIT	A max.	A <sub>1</sub> min.	A <sub>2</sub> max.	b	b <sub>1</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	e <sub>1</sub>	L	M <sub>E</sub>	M <sub>H</sub>	w	Z <sup>(1)</sup> max.
mm	4.2	0.51	3.2	1.73 1.30	0.53 0.38	0.36 0.23	26.92 26.54	6.40 6.22	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	2.0
inches	0.17	0.020	0.13	0.068 0.051	0.021 0.015	0.014 0.009	1.060 1.045	0.25 0.24	0.10	0.30	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.078

**Note**

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

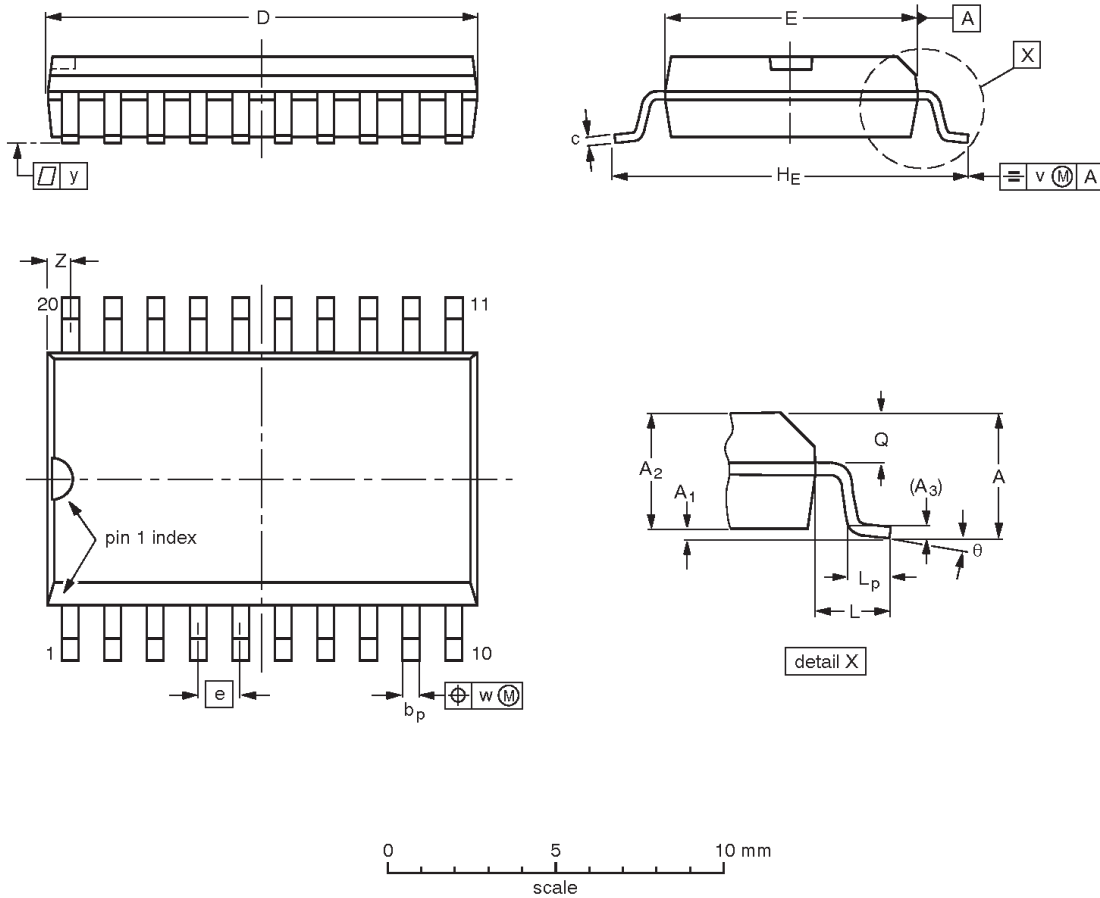
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT146-1			SC603			92-11-17 95-05-24

Octal D-type flip-flop; positive edge-trigger (3-State)

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

SOT163-1



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

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	2.65	0.30 0.10	2.45 2.25	0.25	0.49 0.36	0.32 0.23	13.0 12.6	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8° 0°
inches	0.10	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.51 0.49	0.30 0.29	0.050	0.42 0.39	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

**Note**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

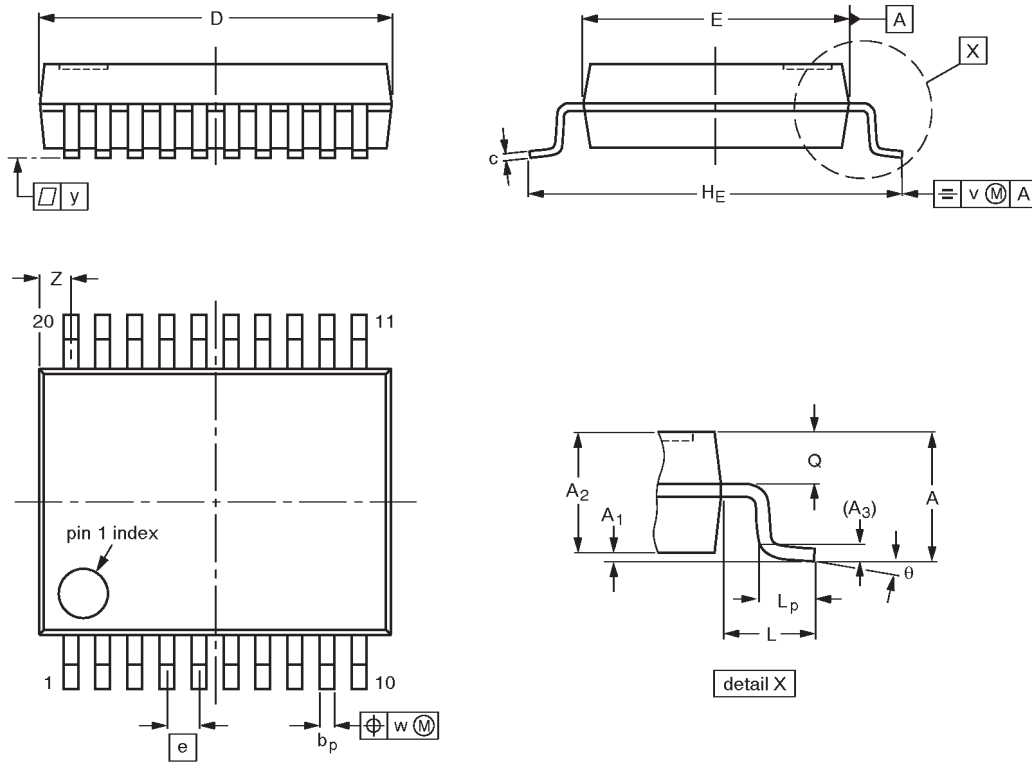
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT163-1	075E04	MS-013AC				92-11-17 95-01-24

# Octal D-type flip-flop; positive edge-trigger (3-State)

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

**SOT339-1**



**DIMENSIONS (mm are the original dimensions)**

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	HE	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	2.0	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 0.20 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT339-1		MO-150AE				93-09-08 95-02-04

## Octal D-type flip-flop; positive edge-trigger (3-State)

74LV374

## DEFINITIONS

Data Sheet Identification	Product Status	Definition
<i>Objective Specification</i>	<b>Formative or in Design</b>	This data sheet contains the design target or goal specifications for product development. Specifications may change in any manner without notice.
<i>Preliminary Specification</i>	<b>Preproduction Product</b>	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
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print code

Date of release: 05-96

Document order number:

9397-750-04448

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