

# DATA SHEET

## **74LVC574A**

Octal D-type flip-flop with 5-volt tolerant inputs/outputs; positive edge-trigger (3-State)

Product specification

1998 Jul 29

# Octal D-type flip-flop with 5-volt tolerant inputs/outputs; positive edge-trigger (3-State)

## 74LVC574A

### FEATURES

- 5-volt tolerant inputs/outputs, for interfacing with 5-volt logic
- Supply voltage range of 2.7V to 3.6V
- Complies with JEDEC standard no. 8-1A
- Inputs accept voltages up to 5.5V
- CMOS low power consumption
- Direct interface with TTL levels
- High impedance when  $V_{CC} = 0V$
- 8-bit positive edge-triggered register
- Independent register and 3-State buffer operation
- Flow-through pin-out architecture

### DESCRIPTION

The 74LVC574A is a high-performance, low-power, low-voltage, Si-gate CMOS device, superior to most advanced CMOS compatible TTL families.

Inputs can be driven from either 3.3V or 5V devices. In 3-State operation, outputs can handle 5V. This feature allows the use of these devices as translators in a mixed 3.3V/5V environment.

The 74LVC574A 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 setup 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.

The '574A' is functionally identical to the '374A', but the '374A' has a different pin arrangement.

### QUICK REFERENCE DATA

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

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT
$t_{PHL}/t_{PLH}$	Propagation delay CP to $Q_n$	$C_L = 50pF$ $V_{CC} = 3.3V$	4.8	ns
$f_{max}$	maximum clock frequency		150	MHz
$C_i$	Input capacitance		5.0	pF
$C_{PD}$	Power dissipation capacitance per flip-flop	Notes 1 and 2	20	pF

#### NOTE:

1.  $C_{PD}$  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 outputs.
2. The condition is  $V_i = GND$  to  $V_{CC}$

### ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	PKG. DWG. #
20-Pin Plastic Shrink Small Outline (SO)	$-40^{\circ}C$ to $+85^{\circ}C$	74LVC574A D	74LVC574A D	SOT163-1
20-Pin Plastic Shrink Small Outline (SSOP) Type II	$-40^{\circ}C$ to $+85^{\circ}C$	74LVC574A DB	74LVC574A DB	SOT339-1
20-Pin Plastic Thin Shrink Small Outline (TSSOP) Type I	$-40^{\circ}C$ to $+85^{\circ}C$	74LVC574A PW	7LVC574APW DH	SOT360-1

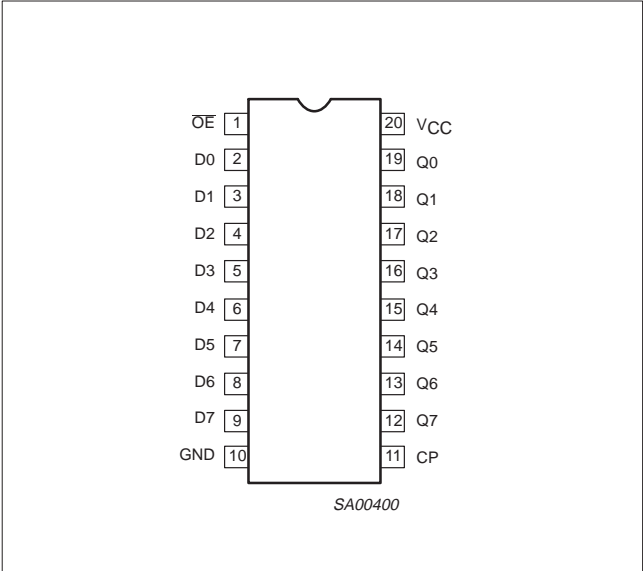
Octal D-type flip-flop with 5-volt tolerant inputs/outputs; positive edge-trigger (3-State)

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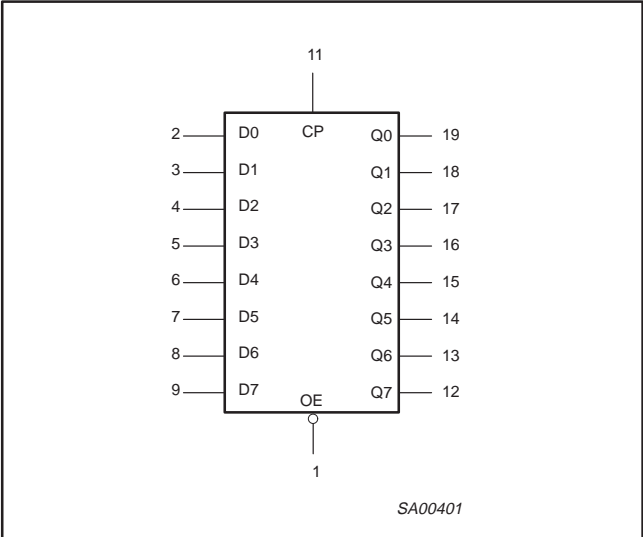
PIN DESCRIPTION

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

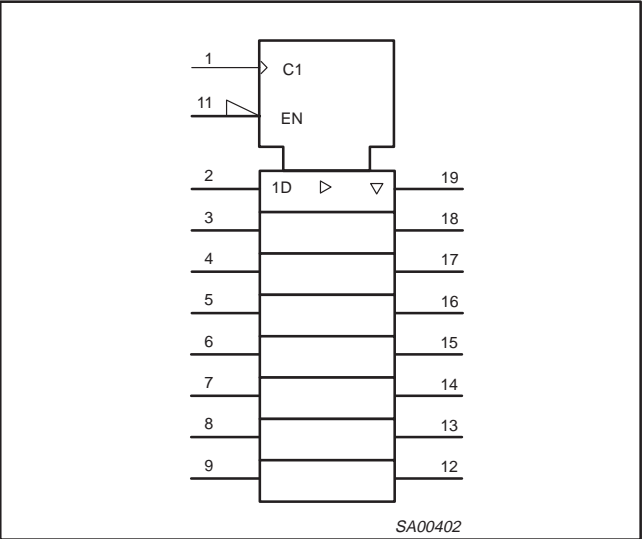
PIN CONFIGURATION



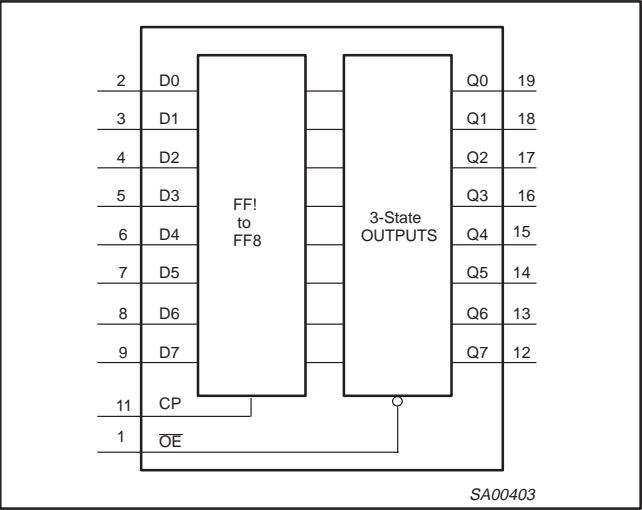
LOGIC SYMBOL



LOGIC SYMBOL (IEEE/IEC)

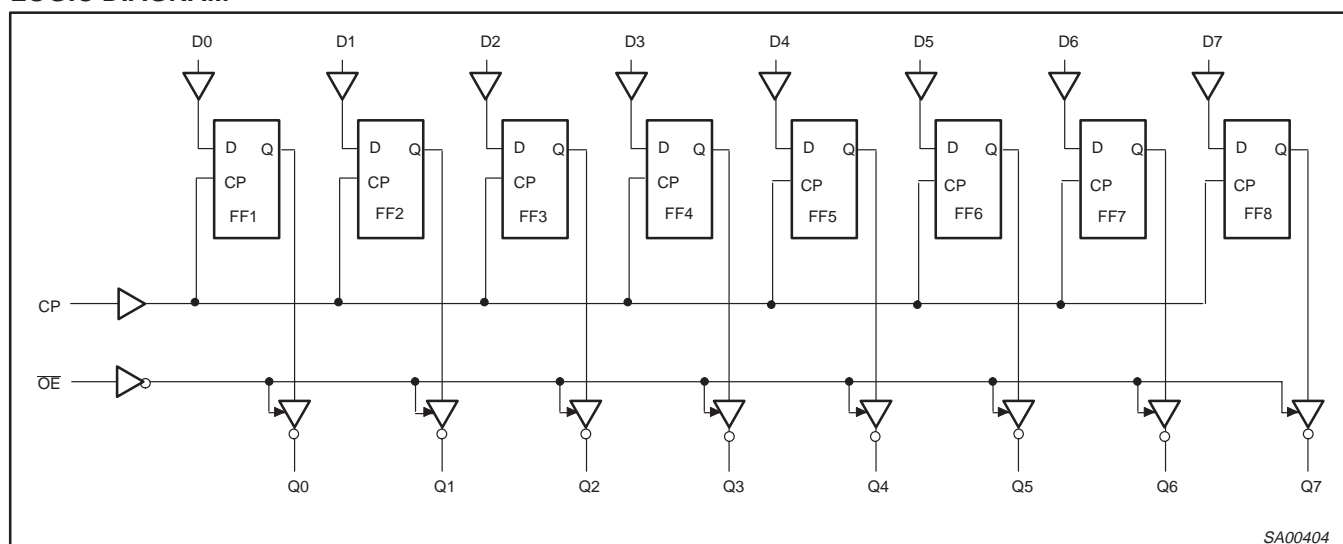


FUNCTIONAL DIAGRAM



## 74LVC574A

### LOGIC DIAGRAM



## FUNCTION TABLE

OPERATING MODES	INPUTS			INTERNAL FLIP-FLOPS	OUTPUTS
	OE	LE	D <sub>n</sub>		Q <sub>0</sub> to Q <sub>7</sub>
Load and read register	L L	↑ ↑	l h	L H	L H
Load register and disable outputs	H H	↑ ↑	l h	L H	Z Z

H = HIGH voltage level

h<sub>1</sub> = HIGH voltage level one setup time prior to the LOW-to-HIGH CP transition

L = LOW voltage level

$t_{1}$  = LOW voltage level one setup time prior to the LOW-to-HIGH CP transition

Z = High impedance OFF-state

↑ = LOW-to-HIGH clock transition

## RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	LIMITS		UNIT
			MIN	MAX	
V <sub>CC</sub>	DC supply voltage (for max. speed performance)		2.7	3.6	V
	DC supply voltage (for low-voltage applications)		1.2	3.6	
V <sub>I</sub>	DC Input voltage range		0	5.5	V
V <sub>O</sub>	DC output voltage range; output HIGH or LOW state		0	V <sub>CC</sub>	V
	DC output voltage range; output 3-State		0	5.5	
T <sub>amb</sub>	Operating ambient temperature range in free-air		−40	+85	°C
t <sub>r</sub> , t <sub>f</sub>	Input rise and fall times	V <sub>CC</sub> = 1.2 to 2.7V V <sub>CC</sub> = 2.7 to 3.6V	0 0	20 10	ns/V

# Octal D-type flip-flop with 5-volt tolerant inputs/outputs; positive edge-trigger (3-State)

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## ABSOLUTE MAXIMUM RATINGS<sup>1</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 +6.5	V
$I_{IK}$	DC input diode current	$V_I < 0$	-50	mA
$V_I$	DC input voltage	Note 2	-0.5 to +6.5	V
$I_{OK}$	DC output diode current	$V_O > V_{CC}$ or $V_O < 0$	$\pm 50$	mA
$V_O$	DC output voltage; output HIGH or LOW state	Note 2	-0.5 to $V_{CC} + 0.5$	V
	DC output voltage; output 3-State	Note 2	-0.5 to 6.5	
$I_O$	DC output source or sink current	$V_O = 0$ to $V_{CC}$	$\pm 50$	mA
$I_{GND}, I_{CC}$	DC $V_{CC}$ or GND current		$\pm 100$	mA
$T_{stg}$	Storage temperature range		-65 to +150	°C
$P_{TOT}$	Power dissipation per package – plastic mini-pack (SO)	above +70°C derate linearly with 8 mW/K	500	mW
	– plastic shrink mini-pack (SSOP and TSSOP)	above +60°C derate linearly with 5.5 mW/K	500	

### 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.

## DC ELECTRICAL CHARACTERISTICS

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

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT
			Temp = -40°C to +85°C			
			MIN	TYP <sup>1</sup>	MAX	
V <sub>IH</sub>	HIGH level Input voltage	V <sub>CC</sub> = 1.2V	V <sub>CC</sub>			V
		V <sub>CC</sub> = 2.7 to 3.6V	2.0			
V <sub>IL</sub>	LOW level Input voltage	V <sub>CC</sub> = 1.2V			GND	V
		V <sub>CC</sub> = 2.7 to 3.6V			0.8	
V <sub>OH</sub>	HIGH level output voltage	V <sub>CC</sub> = 2.7V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -12mA	V <sub>CC</sub> - 0.5			V
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -100μA	V <sub>CC</sub> - 0.2	V <sub>CC</sub>		
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -18mA	V <sub>CC</sub> - 0.6			
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -24mA	V <sub>CC</sub> - 0.8			
V <sub>OL</sub>	LOW level output voltage	V <sub>CC</sub> = 2.7V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 12mA			0.40	V
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 100μA		GND	0.20	
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 24mA			0.55	
I <sub>I</sub>	Input leakage current <sup>2</sup>	V <sub>CC</sub> = 3.6V; V <sub>I</sub> = 5.5V or GND		± 0.1	± 5	μA
I <sub>OZ</sub>	3-State output OFF-state current	V <sub>CC</sub> = 3.6V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = 5.5V or GND		0.1	± 10	μA
I <sub>off</sub>	Power off leakage supply	V <sub>CC</sub> = 0.0V; V <sub>I</sub> or V <sub>O</sub> = 5.5V		0.1	± 10	μA
I <sub>CC</sub>	Quiescent supply current	V <sub>CC</sub> = 3.6V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0		0.1	10	μA
ΔI <sub>CC</sub>	Additional quiescent supply current per input pin	V <sub>CC</sub> = 2.7V to 3.6V; V <sub>I</sub> = V <sub>CC</sub> - 0.6V; I <sub>O</sub> = 0		5	500	μA

### NOTES:

- All typical values are at  $V_{CC} = 3.3V$  and  $T_{amb} = 25^\circ C$ .
- The specified overdrive current at the data input forces the data input to the opposite logic input state.

Octal D-type flip-flop with 5-volt tolerant inputs/outputs; positive edge-trigger (3-State)

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AC CHARACTERISTICS

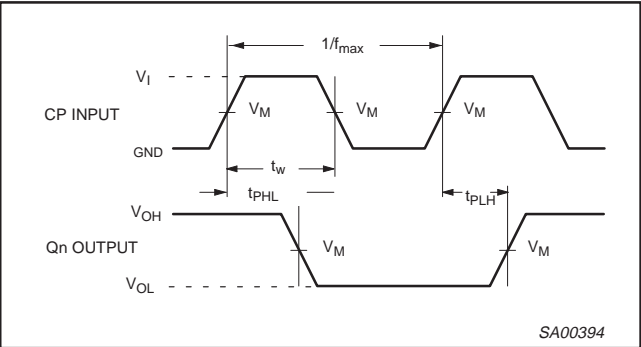
GND = 0V;  $t_r = t_f \leq 2.5\text{ns}$ ;  $C_L = 50\text{pF}$ ;  $R_L = 500\Omega$ ;  $T_{\text{amb}} = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ .

SYMBOL	PARAMETER	WAVEFORM	LIMITS						UNIT
			$V_{CC} = 3.3\text{V} \pm 0.3\text{V}$			$V_{CC} = 2.7\text{V}$		$V_{CC} = 1.2\text{V}$	
			MIN	TYP <sup>1</sup>	MAX	MIN	MAX	TYP	
$t_{\text{PHL}}$ $t_{\text{PLH}}$	Propagation delay CP to $Q_n$	1, 4	1.5	4.8	7.0	1.5	8.0	21	ns
$t_{\text{PZH}}$ $t_{\text{PZL}}$	3-State output enable time $\overline{\text{OE}}$ to $Q_n$	2, 4	1.5	4.0	7.5	1.5	8.5	17	ns
$t_{\text{PHZ}}$ $t_{\text{PLZ}}$	3-State output disable time $\overline{\text{OE}}$ to $Q_n$	2, 4	1.5	3.5	6.0	1.5	6.5	11	ns
$t_W$	Clock pulse width HIGH or LOW	1	3.4	1.7	—	3.4	—	—	ns
$t_{\text{SU}}$	Setup time $D_n$ to CP	3	2.0	0.3	—	2.0	—	—	ns
$t_h$	Hold time $D_n$ to CP	3	1.5	−0.2	—	1.5	—	—	ns
$f_{\text{max}}$	Maximum clock pulse frequency	1	100	—	—	80	—	—	MHz

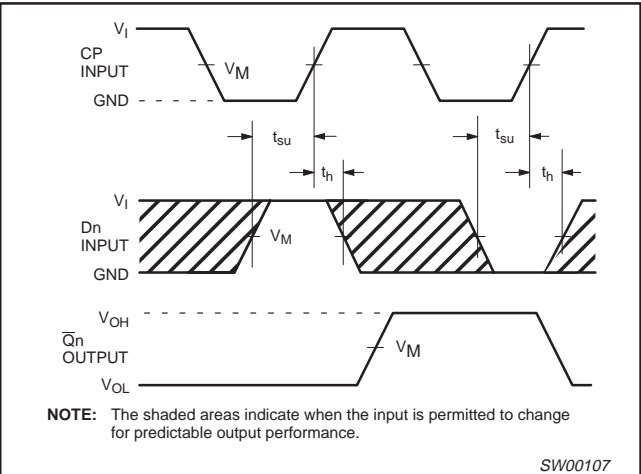
**NOTE:**  
1. Unless otherwise stated, all typical values are at  $V_{CC} = 3.3\text{V}$  and  $T_{\text{amb}} = 25^{\circ}\text{C}$ .

AC WAVEFORMS

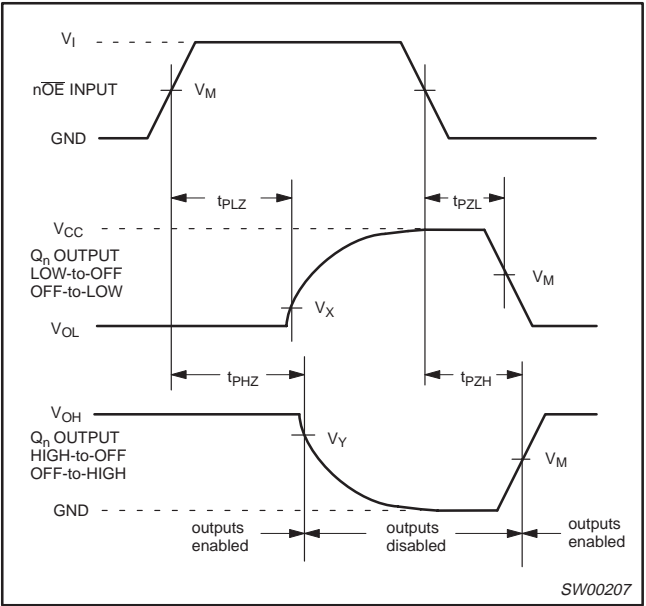
$V_M = 1.5\text{V}$  at  $V_{CC} \geq 2.7\text{V}$ ;  $V_M = 0.5 V_{CC}$  at  $V_{CC} < 2.7\text{V}$ .  
 $V_{OL}$  and  $V_{OH}$  are the typical output voltage drop that occur with the output load.  
 $V_X = V_{OL} + 0.3\text{V}$  at  $V_{CC} \geq 2.7\text{V}$ ;  $V_X = V_{OL} + 0.1 V_{CC}$  at  $V_{CC} < 2.7\text{V}$   
 $V_Y = V_{OH} - 0.3\text{V}$  at  $V_{CC} \geq 2.7\text{V}$ ;  $V_Y = V_{OH} - 0.1 V_{CC}$  at  $V_{CC} < 2.7\text{V}$



Waveform 1. Clock (CP) to output ( $Q_n$ ) propagation delays, the clock pulse width, output transition times and the maximum clock pulse frequency.

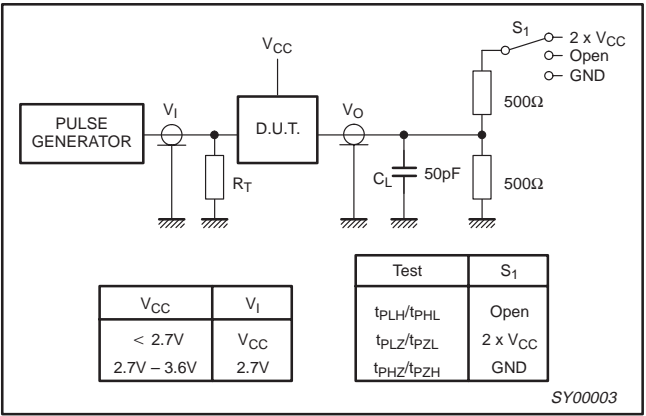


Waveform 2. Data setup and hold times for the  $D_n$  input to the CP input.



Waveform 3. 3-State enable and disable times.

TEST CIRCUIT



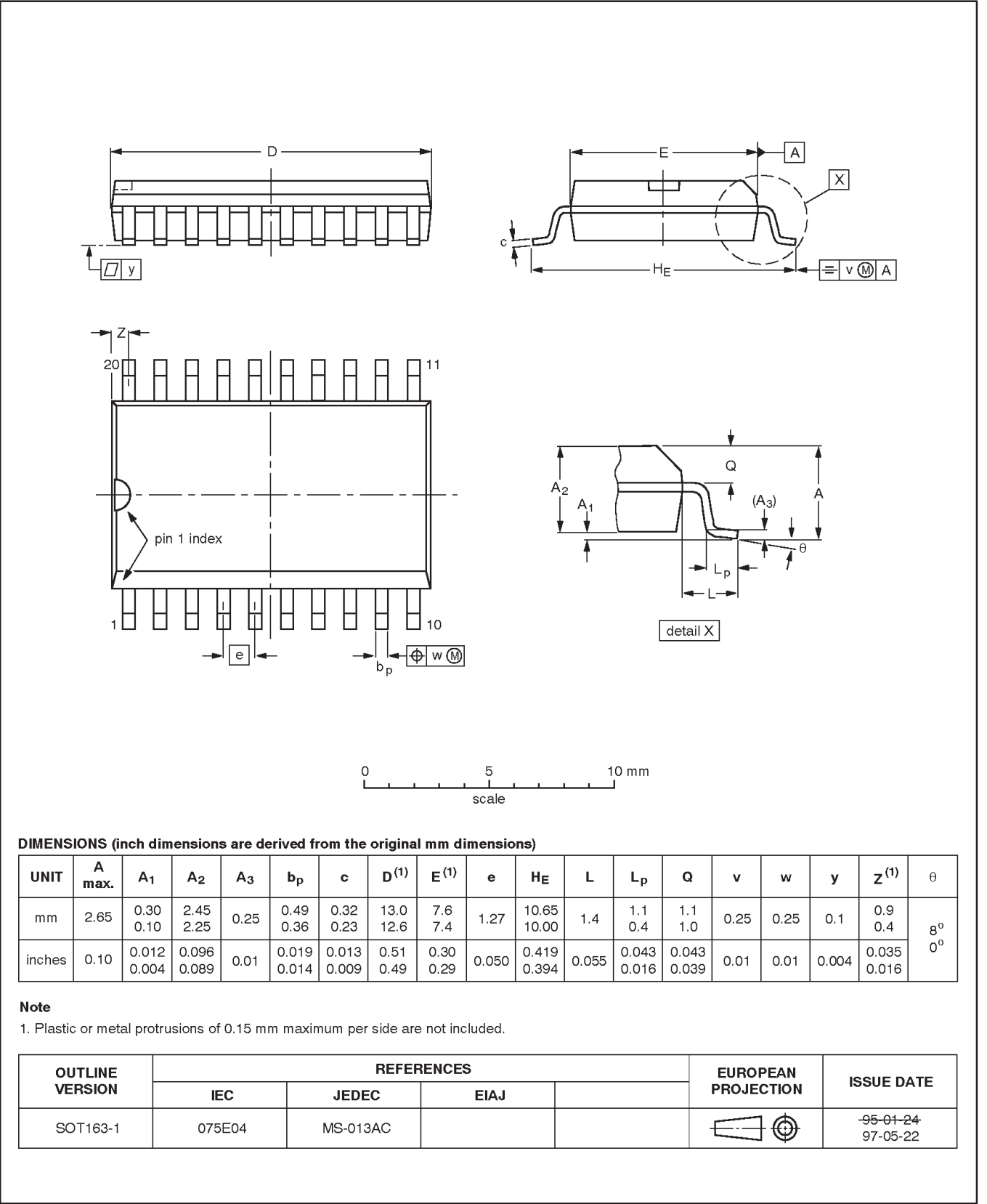
Waveform 4. Load circuitry for switching times.

Octal D-type flip-flop with 5-volt tolerant inputs/outputs; positive edge-trigger (3-State)

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

SOT163-1

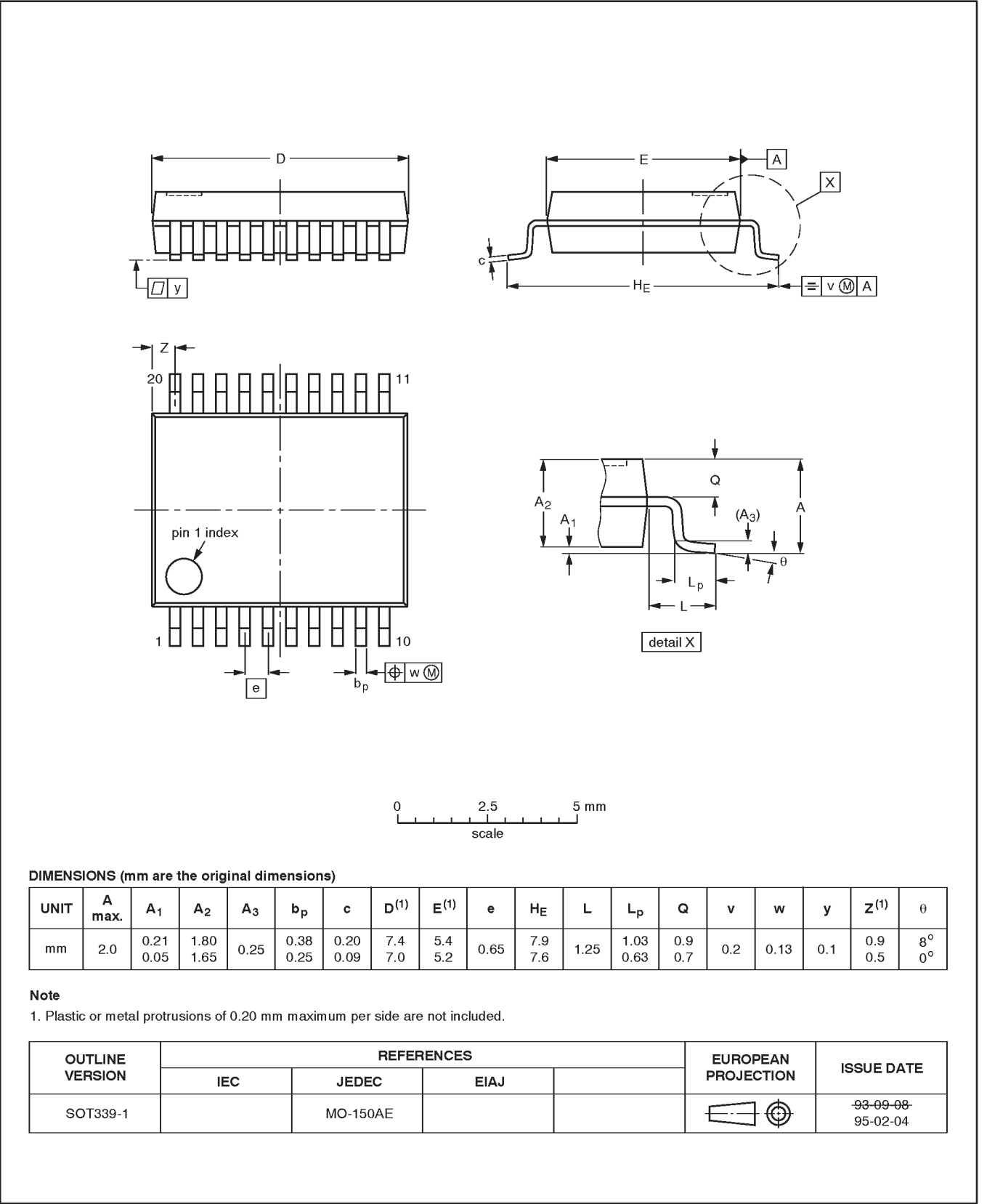


Octal D-type flip-flop with 5-volt tolerant inputs/outputs; positive edge-trigger (3-State)

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

SOT339-1



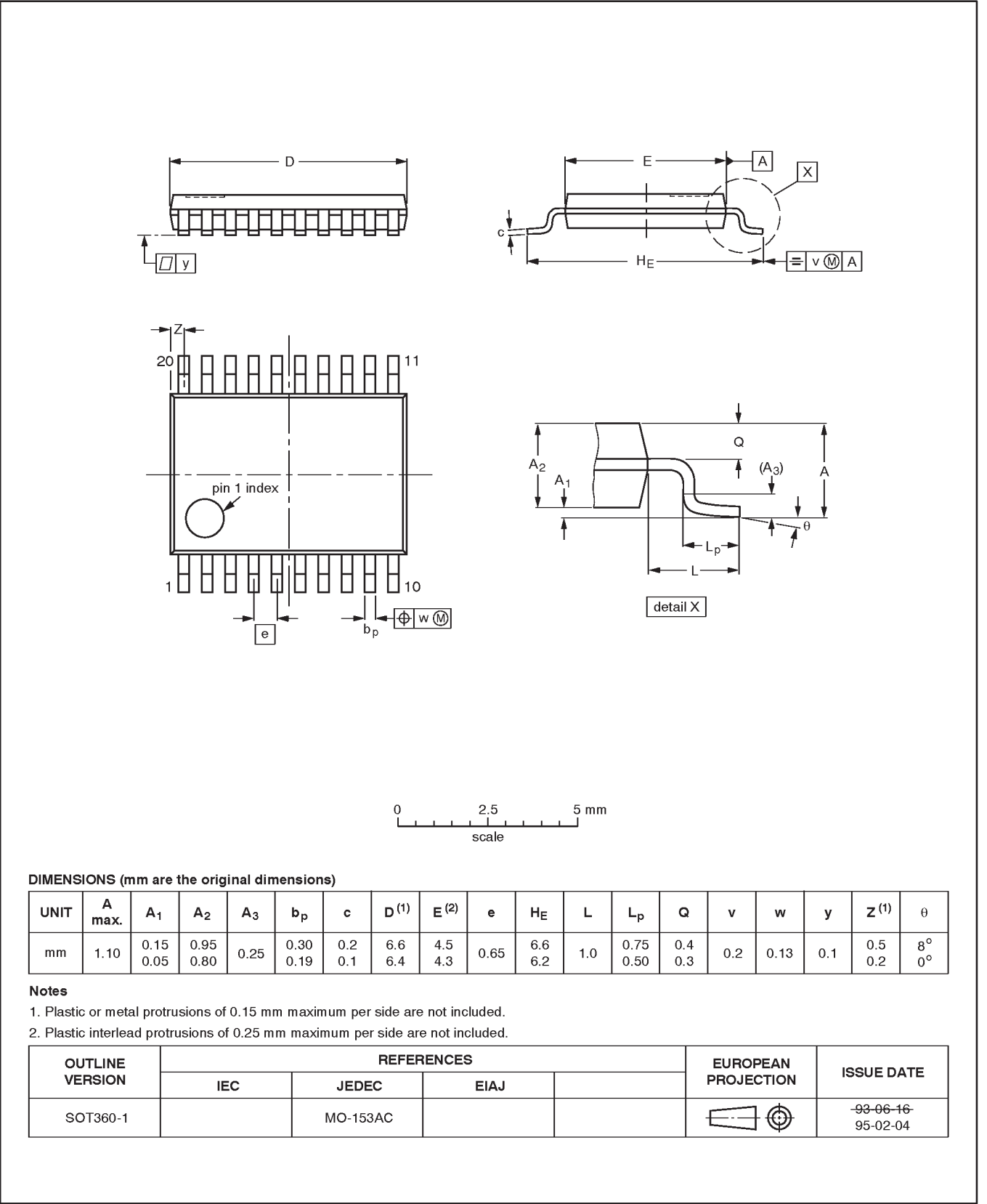


Octal D-type flip-flop with 5-volt tolerant inputs/outputs; positive edge-trigger (3-State)

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

SOT360-1



# Octal D-type flip-flop with 5-volt tolerant inputs/outputs; positive edge-trigger (3-State)

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## Data sheet status

Data sheet status	Product status	Definition [1]
Objective specification	Development	This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.
Preliminary specification	Qualification	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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[1] Please consult the most recently issued datasheet before initiating or completing a design.

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