

# DATA SHEET

## **74F273A** Octal D flip-flop

Product specification

1996 Mar 12

IC15 Data Handbook

# Octal D flip-flop

# 74F273A

## FEATURES

- High impedance inputs for reduced loading (20µA in Low and High states)
- Ideal buffer for MOS microprocessor or memory
- Eight edge-triggered D-type flip-flops
- Buffered common clock
- Buffered asynchronous Master Reset
- See 74F377A for clock enable version
- See 74F373 for transparent latch version
- See 74F374 for 3-State version

## DESCRIPTION

The 74F273 has eight edge-triggered D-type flip-flops with individual D inputs and Q outputs. The common buffered Clock (CP) and Master Reset ( $\overline{MR}$ ) inputs load and reset (clear) all flip-flops simultaneously.

The register is fully edge-triggered. The state of each D input, one setup time before the Low-to-High clock transition, is transferred to the corresponding flip-flop's Q output.

All outputs will be forced Low independently of Clock or Data inputs by a Low voltage level on the  $\overline{MR}$  input. The device is useful for applications where the true output only is required and the CP and  $\overline{MR}$  are common to all elements.

TYPE	TYPICAL $f_{MAX}$	TYPICAL SUPPLY CURRENT (TOTAL)
74F273A	170MHz	25mA

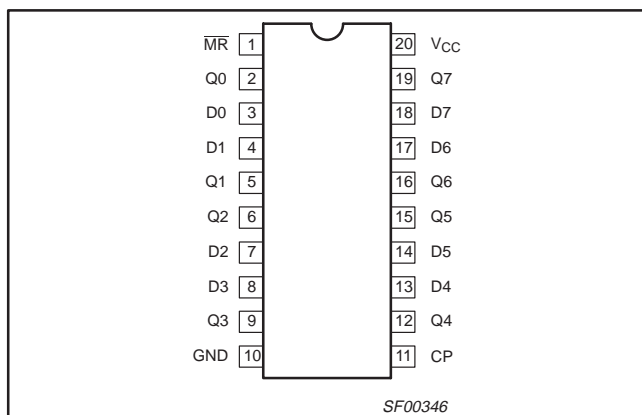
## ORDERING INFORMATION

PACKAGES	COMMERCIAL RANGE $V_{CC} = 5V \pm 10\%$ ; $T_{amb} = 0^\circ C$ to $+70^\circ C$	PKG. DWG. #
20-pin plastic DIP	74F273AN	SOT146-1
20-pin plastic SOL	74F273AD	SOT163-1

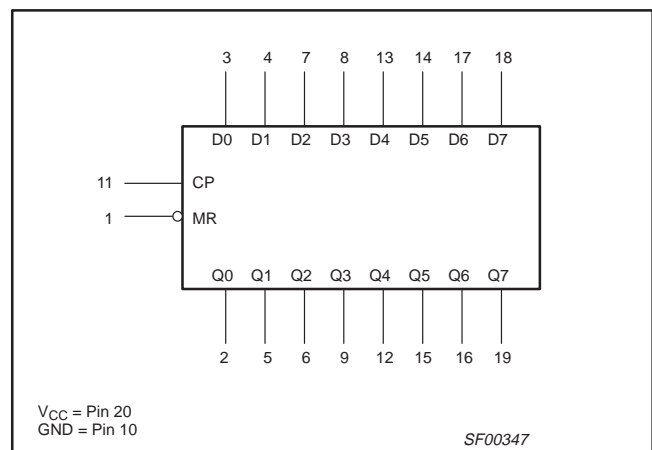
## INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

PINS	DESCRIPTION	74F(U.L.) HIGH/LOW	LOAD VALUE HIGH/LOW
D0 – D7	Data inputs	1.0/0.033	20µA/20µA
$\overline{MR}$	Master Reset input (active-Low)	1.0/0.033	20µA/20µA
CP	Clock pulse input (active rising edge)	1.0/0.033	20µA/20µA
Q0 – Q7	Data outputs	50/33	1.0mA/20mA

## PIN CONFIGURATION



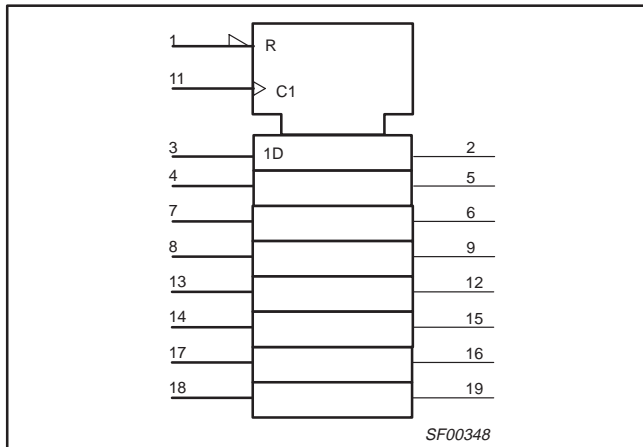
## LOGIC SYMBOL



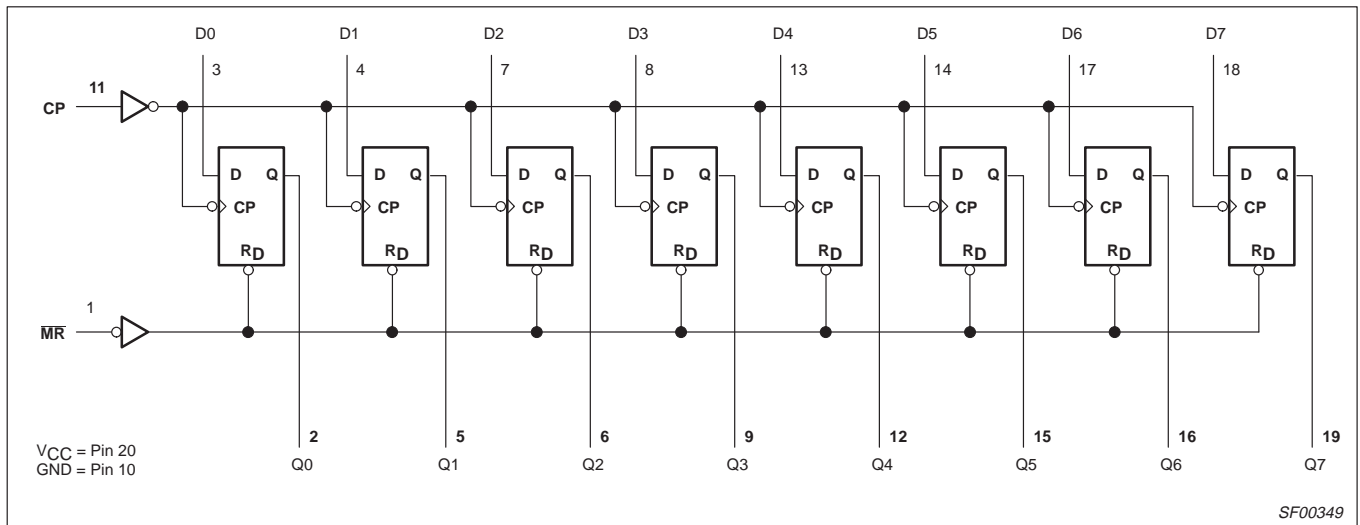
# Octal D flip-flop

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## LOGIC SYMBOL (IEEE/IEC)



## LOGIC DIAGRAM



## FUNCTION TABLE

INPUTS			OUTPUTS	OPERATING MODE
$\overline{MR}$	CP	Dn	Q0 – Q7	
L	X	X	L	Reset (clear)
H	↑	h	H	Load "1"
H	↑	l	L	Load "0"

- H = High voltage level
- h = High voltage level one set-up time prior to the Low-to-High clock transition
- L = Low voltage level
- l = Low voltage level one set-up time prior to the Low-to-High clock transition
- X = Don't care
- ↑ = Low-to-High clock transition

## Octal D flip-flop

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**ABSOLUTE MAXIMUM RATINGS**

(Operation beyond the limit set forth in this table may impair the useful life of the device. Unless otherwise noted these limits are over the operating free air temperature range.)

SYMBOL	PARAMETER	RATING	UNIT
$V_{CC}$	Supply voltage	-0.5 to +7.0	V
$V_{IN}$	Input voltage	-0.5 to +7.0	V
$I_{IN}$	Input current	-30 to +5	mA
$V_{OUT}$	Voltage applied to output in High output state	-0.5 to $V_{CC}$	V
$I_{OUT}$	Current applied to output in Low output state	40	mA
$T_{amb}$	Operating free air temperature range	0 to +70	°C
$T_{stg}$	Storage temperature range	-65 to +150	°C

**RECOMMENDED OPERATING CONDITIONS**

SYMBOL	PARAMETER	LIMITS			UNIT
		MIN	TYP	MAX	
$V_{CC}$	Supply voltage	4.5	5.0	5.5	V
$V_{IH}$	High-level input voltage	2.0			V
$V_{IL}$	Low-level input voltage			0.8	V
$I_{IK}$	Input clamp current			-18	mA
$I_{OH}$	High-level output current			-1	mA
$I_{OL}$	Low-level output current			20	mA
$T_{amb}$	Operating free air temperature range	0		+70	°C

## Octal D flip–flop

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**DC ELECTRICAL CHARACTERISTICS**

(Over recommended operating free-air temperature range unless otherwise noted.)

SYMBOL	PARAMETER		TEST CONDITIONS <sup>1</sup>	LIMITS			UNIT
				MIN	TYP <sup>2</sup>	MAX	
V <sub>OH</sub>	High-level output voltage	MR & CP inputs	V <sub>CC</sub> = MIN, V <sub>IL</sub> = 0.0V <sup>3</sup> , V <sub>IH</sub> = 4.5V <sup>3</sup> , I <sub>OH</sub> = MAX	±10%V <sub>CC</sub>	2.5		V
				±5%V <sub>CC</sub>	2.7	3.4	V
		other inputs	V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, V <sub>IH</sub> = MIN, I <sub>OH</sub> = MAX	±10%V <sub>CC</sub>	2.5		V
				±5%V <sub>CC</sub>	2.7	3.4	V
V <sub>OL</sub>	Low-level output voltage	V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, V <sub>IH</sub> = MIN, I <sub>OH</sub> = MAX	±10%V <sub>CC</sub>		0.30	0.50	V
			±5%V <sub>CC</sub>		0.30	0.50	V
V <sub>IK</sub>	Input clamp voltage	V <sub>CC</sub> = MIN, I <sub>I</sub> = I <sub>IK</sub>		-0.73	-1.2	V	
I <sub>I</sub>	Input current at maximum input voltage	V <sub>CC</sub> = 0.0V, V <sub>I</sub> = 7.0V			100	μA	
I <sub>IH</sub>	High-level input current	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7V			20	μA	
I <sub>IL</sub>	Low-level input current	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.5V			-20	μA	
I <sub>OS</sub>	Short-circuit output current <sup>4</sup>	V <sub>CC</sub> = MAX		-60		-150	mA
I <sub>CC</sub>	Supply current (total)	I <sub>CCH</sub> I <sub>CCL</sub>	V <sub>CC</sub> = MAX		24	38	mA
					27	43	mA

**NOTES:**

- For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
- All typical values are at V<sub>CC</sub> = 5V, T<sub>amb</sub> = 25°C.
- To reduce the effect of external noise during test.
- Not more than one output should be shorted at a time. For testing I<sub>OS</sub>, the use of high-speed test apparatus and/or sample-and-hold techniques are preferable in order to minimize internal heating and more accurately reflect operational values. Otherwise, prolonged shorting of a high output may raise the chip temperature well above normal and thereby cause invalid readings in other parameter tests. In any sequence of parameter tests, I<sub>OS</sub> tests should be performed last.

**AC CHARACTERISTICS FOR 'F273A**

SYMBOL	PARAMETER	WAVEFORM	LIMITS					UNIT
			T <sub>amb</sub> = +25°C V <sub>CC</sub> = +5.0V C <sub>L</sub> = 50pF R <sub>L</sub> = 500Ω			T <sub>amb</sub> = 0°C to +70°C V <sub>CC</sub> = +5.0V ±10% C <sub>L</sub> = 50pF R <sub>L</sub> = 500Ω		
			Min	Typ	Max	Min	Max	
f <sub>MAX</sub>	Maximum clock frequency	1	150	170		125		MHz
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay CP to Qn	1	3.5 5.0	5.0 7.0	8.0 9.5	3.0 4.5	9.0 10.0	ns
t <sub>PHL</sub>	Propagation delay MR to Qn	2	5.0	7.0	9.0	5.0	9.5	ns

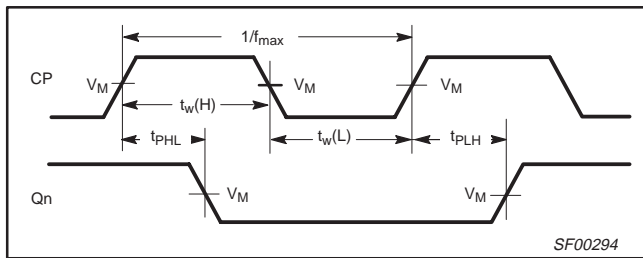
# Octal D flip-flop

# 74F273A

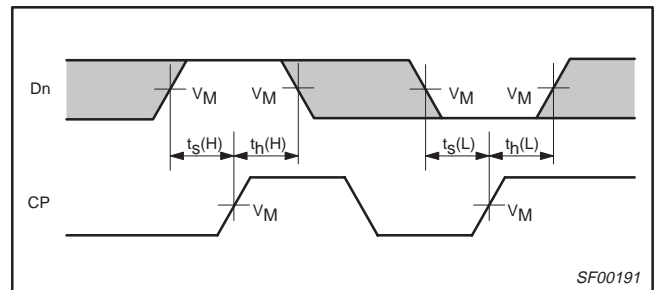
## AC SETUP REQUIREMENTS FOR 'F273A

SYMBOL	PARAMETER	WAVEFORM	LIMITS					UNIT
			T <sub>amb</sub> = +25°C V <sub>CC</sub> = +5.0V C <sub>L</sub> = 50pF R <sub>L</sub> = 500Ω			T <sub>amb</sub> = 0°C to +70°C V <sub>CC</sub> = +5.0V ±10% C <sub>L</sub> = 50pF R <sub>L</sub> = 500Ω		
			Min	Typ	Max	Min	Max	
t <sub>s</sub> (H) t <sub>s</sub> (L)	Setup time, High or Low Dn to CP	3	3.0 2.0			2.5 2.5		
t <sub>h</sub> (H) t <sub>h</sub> (L)	Hold time, High or Low Dn to CP	3	0.5 0.0			2.5 1.0		ns
t <sub>w</sub> (H) t <sub>w</sub> (L)	Clock pulse width High or Low	1	4.5 3.5			5.0 4.0		ns
t <sub>w</sub> (L)	Master Reset pulse width, Low	2	3.0			3.5		ns
t <sub>REC</sub>	Recovery time MR to CP	2	4.0			5.0		ns

## AC WAVEFORMS

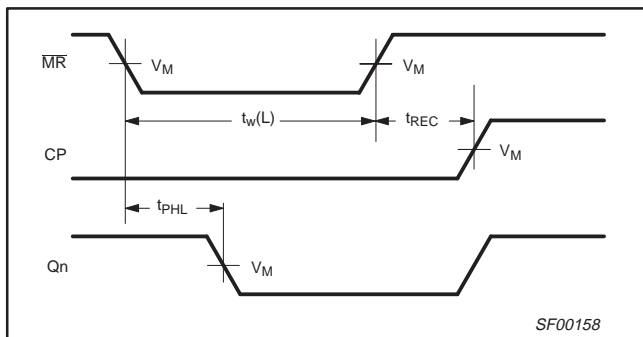


**Waveform 1. Propagation Delay, Clock Input to Output, Clock Pulse Width, and Maximum Clock Frequency**



**Waveform 3. Data Setup and Hold Times**

**NOTE:** For all waveforms, V<sub>M</sub> = 1.5V.  
The shaded areas indicate when the input is permitted to change for predictable output performance.

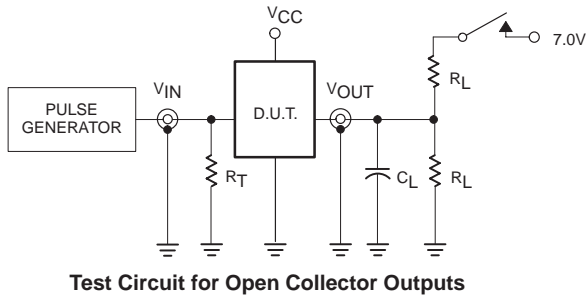


**Waveform 2. Master Reset Pulse Width, Master Reset to Output Delay and Master Reset to Clock Recovery Time**

# Octal D flip-flop

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## TEST CIRCUIT AND WAVEFORMS



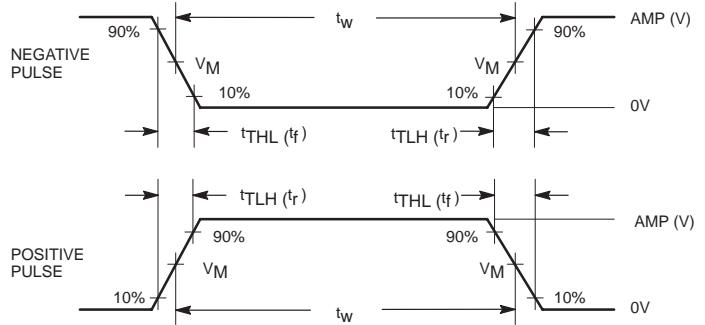
Test Circuit for Open Collector Outputs

### SWITCH POSITION

TEST	SWITCH
$t_{PLZ}$	closed
$t_{PZL}$	closed
All other	open

### DEFINITIONS:

- $R_L$  = Load resistor; see AC electrical characteristics for value.
- $C_L$  = Load capacitance includes jig and probe capacitance; see AC electrical characteristics for value.
- $R_T$  = Termination resistance should be equal to  $Z_{OUT}$  of pulse generators.



Input Pulse Definition

family	INPUT PULSE REQUIREMENTS					
	amplitude	$V_M$	rep. rate	$t_w$	$t_{TLH}$	$t_{THL}$
74F	3.0V	1.5V	1MHz	500ns	2.5ns	2.5ns

SF00128

# Octal D flip-flop

## 74F273A

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 flip-flop

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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	0.419 0.394	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				95-01-24 97-05-22

## Octal D flip-flop

74F273A

## 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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Philips Semiconductors  
811 East Arques Avenue  
P.O. Box 3409  
Sunnyvale, California 94088-3409  
Telephone 800-234-7381

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