

54F/74F374

Octal D-Type Flip-Flop with TRI-STATE® Outputs

General Description

The 'F374 is a high-speed, low-power octal D-type flip-flop featuring separate D-type inputs for each flip-flop and TRI-STATE outputs for bus-oriented applications. A buffered Clock (CP) and Output Enable (\overline{OE}) are common to all flip-flops.

Features

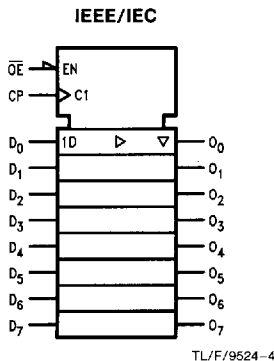
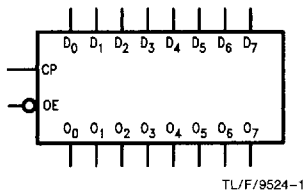
- Edge-triggered D-type inputs
- Buffered positive edge-triggered clock
- TRI-STATE outputs for bus-oriented applications
- Guaranteed 4000V minimum ESD protection

Ordering Code: See Section 11

Commercial	Military	Package Number	Package Description
74F374PC		N20A	20-Lead (0.300" Wide) Molded Dual-In-Line
	54F374DM (QB)	J20A	20-Lead Ceramic Dual-In-Line
74F374SC (Note 1)		M20B	20-Lead (0.300" Wide) Molded Small Outline, JEDEC
74F374SJ (Note 1)		M20D	20-Lead (0.300" Wide) Molded Small Outline, EIAJ
74F374MSA (Note 1)		MSA20	20-Lead Molded Shrink Small Outline, EIAJ Type II
	54F374FM (QB)	W20A	20-Lead Cerpack
	54F374LM (QB)	E20A	20-Lead Ceramic Leadless Chip Carrier, Type C

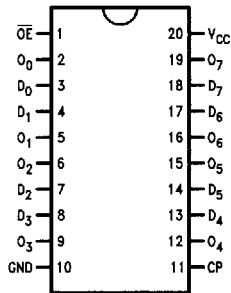
Note 1: Devices also available in 13" reel. Use suffix = SCX, SJX, and MSAX.

Logic Symbols

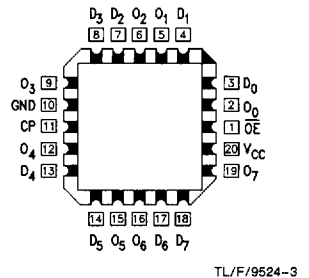


Connection Diagrams

Pin Assignment for DIP, SOIC, SSOP and Flatpak



Pin Assignment for LCC





Unit Loading/Fan Out: See Section 2 for U.L. Definitions

Pin Names	Description	54F/74F	
		U.L. HIGH/LOW	Input I_{IH}/I_{IL} Output I_{OH}/I_{OL}
D ₀ -D ₇	Data Inputs	1.0/1.0	20 μ A/ -0.6 mA
CP	Clock Pulse Input (Active Rising Edge)	1.0/1.0	20 μ A/ -0.6 mA
\overline{OE}	TRI-STATE Output Enable Input (Active LOW)	1.0/1.0	20 μ A/ -0.6 mA
O ₀ -O ₇	TRI-STATE Outputs	150/40 (33.3)	-3 mA/24 mA (20 mA)

Functional Description

The 'F374 consists of eight edge-triggered flip-flops with individual D-type inputs and TRI-STATE true outputs. The buffered clock and buffered Output Enable 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 time requirements on the LOW-to-HIGH Clock (CP) transition. With the Output Enable (\overline{OE}) LOW, the contents of the eight flip-flops are available at the outputs. When the \overline{OE} is HIGH, the outputs go to the high impedance state. Operation of the \overline{OE} input does not affect the state of the flip-flops.

Truth Table


Inputs			Internal Register	Output
D _n	CP	\overline{OE}		O _n
H		L	H	H
L		L	L	L
X	X	H	X	Z

H = HIGH Voltage Level

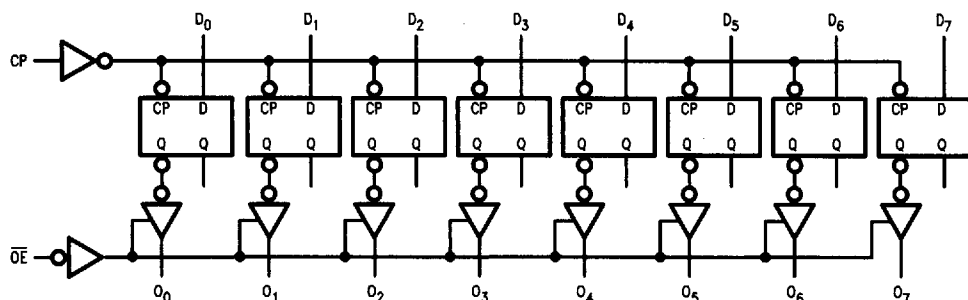
L = LOW Voltage Level

X = Immaterial

Z = High Impedance

 = LOW-to-HIGH Clock Transition

Logic Diagram



TL/F/9524-5

Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Storage Temperature	-65°C to +150°C
Ambient Temperature under Bias	-55°C to +125°C
Junction Temperature under Bias	-55°C to +175°C
Plastic	-55°C to +150°C
V _{CC} Pin Potential to Ground Pin	-0.5V to +7.0V
Input Voltage (Note 2)	-0.5V to +7.0V
Input Current (Note 2)	-30 mA to +5.0 mA
Voltage Applied to Output in HIGH State (with V _{CC} = 0V)	
Standard Output	-0.5V to V _{CC}
TRI-STATE Output	-0.5V to +5.5V
Current Applied to Output in LOW State (Max)	twice the rated I _{OL} (mA)

ESD Last Passing Voltage (Min)

4000V

Note 1: Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

Note 2: Either voltage limit or current limit is sufficient to protect inputs.

Recommended Operating Conditions

Free Air Ambient Temperature

Military

-55°C to +125°C

Commercial

0°C to +70°C

Supply Voltage

Military

+4.5V to +5.5V

Commercial

+4.5V to +5.5V

DC Electrical Characteristics

Symbol	Parameter	54F/74F			Units	V _{CC}	Conditions	
		Min	Typ	Max				
V _{IH}	Input HIGH Voltage	2.0			V		Recognized as a HIGH Signal	
V _{IL}	Input LOW Voltage			0.8	V		Recognized as a LOW Signal	
V _{CD}	Input Clamp Diode Voltage			-1.2	V	Min	I _{IN} = -18 mA	
V _{OH}	Output HIGH Voltage	54F 10% V _{CC}	2.5		V	Min	I _{OH} = -1 mA	
		54F 10% V _{CC}	2.4				I _{OH} = -3 mA	
		74F 10% V _{CC}	2.5				I _{OH} = -1 mA	
		74F 10% V _{CC}	2.4				I _{OH} = -3 mA	
		74F 5% V _{CC}	2.7				I _{OH} = -1 mA	
		74F 5% V _{CC}	2.7				I _{OH} = -3 mA	
V _{OL}	Output LOW Voltage	54F 10% V _{CC}		0.5	V	Min	I _{OL} = 20 mA	
		74F 10% V _{CC}		0.5			I _{OL} = 24 mA	
I _{IH}	Input HIGH Current	54F		20.0	μA	Max	V _{IN} = 2.7V	
		74F		5.0				
I _{BVI}	Input HIGH Current Breakdown Test	54F		100	μA	Max	V _{IN} = 7.0V	
		74F		7.0				
I _{CEX}	Output HIGH Leakage Current	54F		250	μA	Max	V _{OUT} = V _{CC}	
		74F		50				
V _{ID}	Input Leakage Test	74F	4.75		V	0.0	I _{ID} = 1.9 μA All Other Pins Grounded	
I _{OD}	Output Leakage Circuit Current	74F		3.75	μA	0.0	V _{IOD} = 150 mV All Other Pins Grounded	
I _{IL}	Input LOW Current			-0.6	mA	Max	V _{IN} = 0.5V	
I _{OZH}	Output Leakage Current			50	μA	Max	V _{OUT} = 2.7V	
I _{OZL}	Output Leakage Current			-50	μA	Max	V _{OUT} = 0.5V	
I _{OS}	Output Short-Circuit Current			-60	mA	Max	V _{OUT} = 0V	
I _{ZZ}	Bus Drainage Test			500	μA	0.0V	V _{OUT} = 5.25V	
I _{CCZ}	Power Supply Current			55	86	mA	Max	V _O = HIGH Z

AC Electrical Characteristics: See Section 2 for Waveforms and Load Configurations

Symbol	Parameter	74F			54F		74F		Units	Fig. No.
		$T_A = +25^\circ\text{C}$ $V_{CC} = +5.0\text{V}$ $C_L = 50\text{ pF}$			$T_A, V_{CC} = \text{Mil}$ $C_L = 50\text{ pF}$		$T_A, V_{CC} = \text{Com}$ $C_L = 50\text{ pF}$			
		Min	Typ	Max	Min	Max	Min	Max		
f_{max}	Maximum Clock Frequency	100	140		60		70		MHz	2-1
t_{PLH}	Propagation Delay CP to O_n	4.0	6.5	8.5	4.0	10.5	4.0	10.0	ns	2-3
t_{PHL}		4.0	6.5	8.5	4.0	11.0	4.0	10.0		
t_{PZH}	Output Enable Time	2.0	9.0	11.5	2.0	14.0	2.0	12.5	ns	2-5
t_{PZL}		2.0	5.8	7.5	2.0	10.0	2.0	8.5		
t_{PHZ}	Output Disable Time	2.0	5.3	7.0	2.0	8.0	2.0	8.0	ns	2-5
t_{PLZ}		1.5	4.3	5.5	1.5	7.5	1.5	6.5		

AC Operating Requirements: See Section 2 for Waveforms

Symbol	Parameter	74F		54F		74F		Units	Fig. No.
		$T_A = +25^\circ\text{C}$ $V_{CC} = +5.0\text{V}$		$T_A, V_{CC} = \text{Mil}$		$T_A, V_{CC} = \text{Com}$			
		Min	Max	Min	Max	Min	Max		
$t_{\text{s}}(\text{H})$	Setup Time, HIGH or LOW	2.0		2.5		2.0		ns	2-6
$t_{\text{s}}(\text{L})$	D_n to CP	2.0		2.0		2.0			
$t_{\text{h}}(\text{H})$	Hold Time, HIGH or LOW	2.0		2.0		2.0		ns	2-6
$t_{\text{h}}(\text{L})$	D_n to CP	2.0		2.5		2.0			
$t_{\text{w}}(\text{H})$	CP Pulse Width	7.0		7.0		7.0		ns	2-4
$t_{\text{w}}(\text{L})$	HIGH or LOW	6.0		6.0		6.0			