

54F/74F175 Quad D Flip-Flop

General Description

The 'F175 is a high-speed quad D flip-flop. The device is useful for general flip-flop requirements where clock and clear inputs are common. The information on the D inputs is stored during the LOW-to-HIGH clock transition. Both true and complemented outputs of each flip-flop are provided. A Master Reset input resets all flip-flops, independent of the Clock or D inputs, LOW.

Features

- Edge-triggered D-type inputs
- Buffered positive edge-triggered clock
- Asynchronous common reset
- True and complement output
- Guaranteed 4000V minimum ESD protection

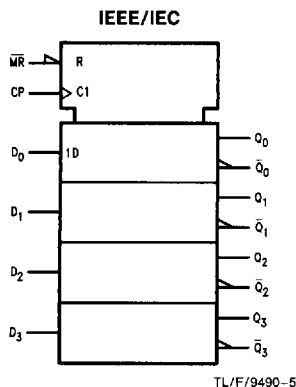
Ordering Code: See Section 11

Commercial	Military	Package Number	Package Description
74F175PC		N16E	16-Lead (0.300" Wide) Molded Dual-In-Line
	54F175DM (Note 2)	J16A	16-Lead Ceramic Dual-In-Line
74F175SC (Note 1)		M16A	16-Lead (0.150" Wide) Molded Small Outline, JEDEC
74F175SJ (Note 1)		M16D	16-Lead (0.300" Wide) Molded Small Outline, EIAJ
	54F175FM (Note 2)	W16A	16-Lead Cerpack
	54F175LM (Note 2)	E20A	20-Lead Ceramic Leadless Chip Carrier, Type C

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

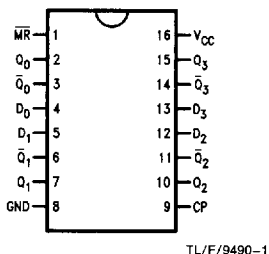
Note 2: Military grade device with environmental and burn-in processing. Use suffix = DMQB, FMQB and LMQB.

Logic Symbols

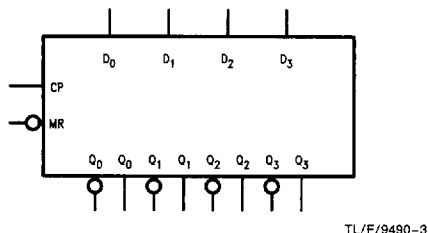
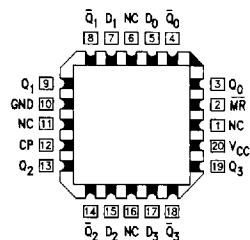


Connection Diagrams

Pin Assignment for DIP, SOIC 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_3	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
$\overline{MR}$	Master Reset Input (Active LOW)	1.0/1.0	20 μ A/ -0.6 mA
Q_0-Q_3	True Outputs	50/33.3	-1 mA/20 mA
$\overline{Q}_0-\overline{Q}_3$	Complement Outputs	50/33.3	-1 mA/20 mA

Functional Description

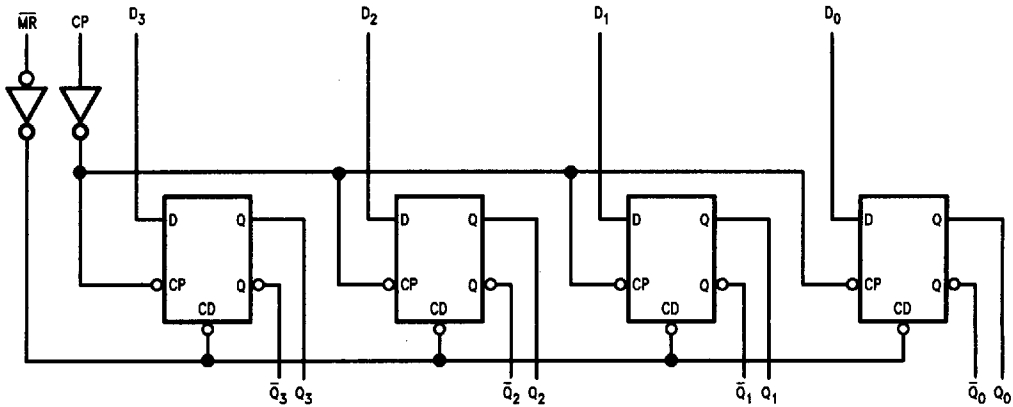
The 'F175 consists of four edge-triggered D flip-flops with individual D inputs and Q and $\overline{Q}$ outputs. The Clock and Master Reset are common. The four flip-flops will store the state of their individual D inputs on the LOW-to-HIGH clock (CP) transition, causing individual Q and $\overline{Q}$ outputs to follow. A LOW input on the Master Reset ($\overline{MR}$) will force all Q outputs LOW and $\overline{Q}$ outputs HIGH independent of Clock or Data inputs. The 'F175 is useful for general logic applications where a common Master Reset and Clock are acceptable.

Truth Table

Inputs			Outputs	
$\overline{MR}$	CP	D_n	Q_n	$\overline{Q}_n$
L	X	X	L	H
H		H	H	L
H		L	L	H

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial
 = LOW-to-HIGH Clock Transition

Logic Diagram



TL/F/9490-4

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)

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	$I_{IN} = -18 \text{ mA}$
V_{OH}	Output HIGH Voltage	54F 10% V_{CC}	2.5		V	Min	$I_{OH} = -1 \text{ mA}$
		74F 10% V_{CC}	2.5				$I_{OH} = -1 \text{ mA}$
		74F 5% V_{CC}	2.7				$I_{OH} = -1 \text{ mA}$
V_{OL}	Output LOW Voltage	54F 10% V_{CC}		0.5	V	Min	$I_{OL} = 20 \text{ mA}$
		74F 10% V_{CC}		0.5			$I_{OL} = 20 \text{ mA}$
I_{IH}	Input HIGH Current	54F		20.0	μA	Max	$V_{IN} = 2.7V$
		74F		5.0			
I_{BI}	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	$I_{ID} = 1.9 \mu\text{A}$ All Other Pins Grounded
I_{OD}	Output Leakage Circuit Current	74F		3.75	μA	0.0	$V_{IOD} = 150 \text{ mV}$ All Other Pins Grounded
I_{IL}	Input LOW Current			-0.6	mA	Max	$V_{IN} = 0.5V$
I_{OS}	Output Short-Circuit Current		-60	-150	mA	Max	$V_{OUT} = 0V$
I_{CC}	Power Supply Current		22.5	34.0	mA	Max	CP =  $D_n = \overline{MR} = \text{HIGH}$

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		80		100		MHz	2-1
t_{PLH}	Propagation Delay	4.0	5.0	6.5	3.5	8.5	4.0	7.5	ns	2-3
t_{PHL}	CP to Q_n or $\bar{Q}_n$	4.0	6.5	8.5	4.0	10.5	4.0	9.5		
t_{PHL}	Propagation Delay	4.5	9.0	11.5	4.5	15.0	4.5	13.0	ns	2-3
t_{PLH}	Propagation Delay	4.0	6.5	8.0	4.0	10.0	4.0	9.0	ns	2-3

AC Operating Requirements: See Section 2 for Waveforms

Symbol	Parameter	74F		54F		74F		Units	Fig. No.
		$T_A = +25^{\circ}\text{C}$ $V_{CC} = +5.0\text{V}$		$T_A, V_{CC} = \text{MII}$		$T_A, V_{CC} = \text{Com}$			
		Min	Max	Min	Max	Min	Max		
$t_s(\text{H})$	Setup Time, HIGH or LOW	3.0		3.0		3.0		ns	2-6
$t_s(\text{L})$	D_n to CP	3.0		3.0		3.0			
$t_h(\text{H})$	Hold Time, HIGH or LOW	1.0		1.0		1.0		ns	2-6
$t_h(\text{L})$	D_n to CP	1.0		2.0		1.0			
$t_w(\text{H})$	CP Pulse Width	4.0		4.0		4.0		ns	2-4
$t_w(\text{L})$	HIGH or LOW	5.0		5.0		5.0			
$t_w(\text{L})$	$\overline{\text{MR}}$ Pulse Width, LOW	5.0		5.0		5.0		ns	2-4
t_{rec}	Recovery Time, $\overline{\text{MR}}$ to CP	5.0		5.0		5.0		ns	2-6