

## 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

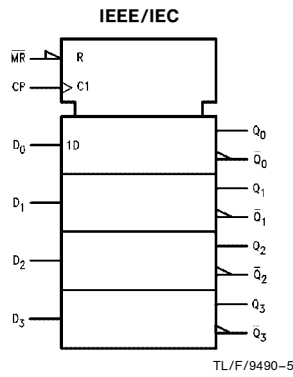
- Edge-triggered D-type inputs
- Buffered positive edge-triggered clock
- Asynchronous common reset
- True and complement output
- Guaranteed 4000V minimum ESD protection

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

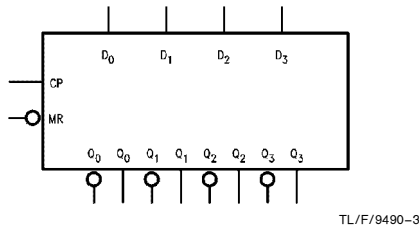
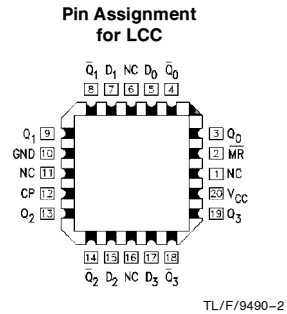
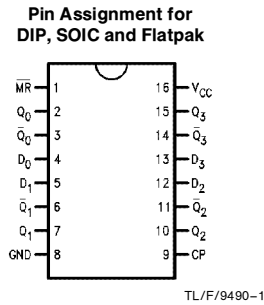
**Note 1:** Devices also available in 13" reel. Use suffix = SCX and SJX.

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

### Logic Symbols



### Connection Diagrams



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## Unit Loading/Fan Out

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 $\mu$ A/–0.6 mA
CP	Clock Pulse Input (Active Rising Edge)	1.0/1.0	20 $\mu$ A/–0.6 mA
$\overline{MR}$	Master Reset Input (Active LOW)	1.0/1.0	20 $\mu$ 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

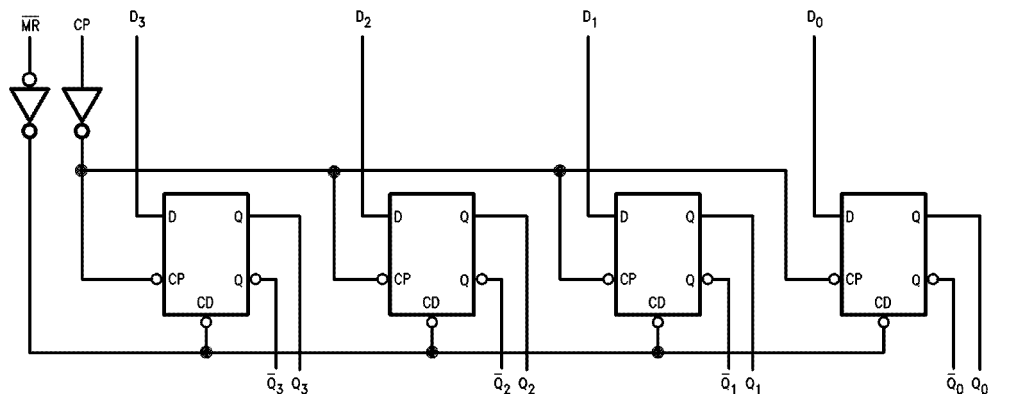
The 'F175 consists of four edge-triggered D flip-flops with individual D inputs and Q and  $\overline{Q}$  outputs. The Clock and Master Reset are common. The four flip-flops will store the state of their individual D inputs on the LOW-to-HIGH clock (CP) transition, causing individual Q and  $\overline{Q}$  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	$\nearrow$	H	H	L
H	$\nearrow$	L	L	H

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

## Logic Diagram



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 <sub>CC</sub> 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 <sub>CC</sub> = 0V)	
Standard Output	-0.5V to V <sub>CC</sub>
TRI-STATE® Output	-0.5V to +5.5V
Current Applied to Output in LOW State (Max)	twice the rated I <sub>OL</sub> (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 <sub>CC</sub>	Conditions
		Min	Typ	Max			
V <sub>IH</sub>	Input HIGH Voltage	2.0			V		Recognized as a HIGH Signal
V <sub>IL</sub>	Input LOW Voltage			0.8	V		Recognized as a LOW Signal
V <sub>CD</sub>	Input Clamp Diode Voltage			-1.2	V	Min	I <sub>IN</sub> = -18 mA
V <sub>OH</sub>	Output HIGH Voltage	54F 10% V <sub>CC</sub> 74F 10% V <sub>CC</sub> 74F 5% V <sub>CC</sub>	2.5 2.5 2.7		V	Min	I <sub>OH</sub> = -1 mA I <sub>OH</sub> = -1 mA I <sub>OH</sub> = -1 mA
V <sub>OL</sub>	Output LOW Voltage	54F 10% V <sub>CC</sub> 74F 10% V <sub>CC</sub>		0.5 0.5	V	Min	I <sub>OL</sub> = 20 mA I <sub>OL</sub> = 20 mA
I <sub>IH</sub>	Input HIGH Current	54F 74F		20.0 5.0	μA	Max	V <sub>IN</sub> = 2.7V
I <sub>BVI</sub>	Input HIGH Current Breakdown Test	54F 74F		100 7.0	μA	Max	V <sub>IN</sub> = 7.0V
I <sub>CEX</sub>	Output HIGH Leakage Current	54F 74F		250 50	μA	Max	V <sub>OUT</sub> = V <sub>CC</sub>
V <sub>ID</sub>	Input Leakage Test	74F	4.75		V	0.0	I <sub>ID</sub> = 1.9 μA All Other Pins Grounded
I <sub>OD</sub>	Output Leakage Circuit Current	74F		3.75	μA	0.0	V <sub>ID</sub> = 150 mV All Other Pins Grounded
I <sub>IL</sub>	Input LOW Current			-0.6	mA	Max	V <sub>IN</sub> = 0.5V
I <sub>OS</sub>	Output Short-Circuit Current			-60	mA	Max	V <sub>OUT</sub> = 0V
I <sub>CC</sub>	Power Supply Current		22.5	34.0	mA	Max	CP =  D <sub>n</sub> = $\overline{MR}$ = HIGH

### AC Electrical Characteristics

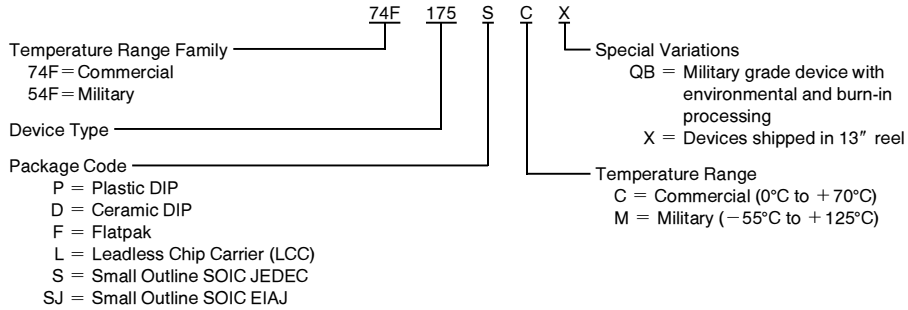
Symbol	Parameter	74F			54F		74F		Units
		T <sub>A</sub> = +25°C V <sub>CC</sub> = +5.0V C <sub>L</sub> = 50 pF			T <sub>A</sub> , V <sub>CC</sub> = Mil C <sub>L</sub> = 50 pF		T <sub>A</sub> , V <sub>CC</sub> = Com C <sub>L</sub> = 50 pF		
		Min	Typ	Max	Min	Max	Min	Max	
f <sub>max</sub>	Maximum Clock Frequency	100	140		80		100		MHz
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay CP to Q <sub>n</sub> or $\overline{Q}_n$	4.0	5.0	6.5	3.5	8.5	4.0	7.5	ns
		4.0	6.5	8.5	4.0	10.5	4.0	9.5	
t <sub>PHL</sub>	Propagation Delay $\overline{MR}$ to Q <sub>n</sub>	4.5	9.0	11.5	4.5	15.0	4.5	13.0	ns
t <sub>PLH</sub>	Propagation Delay $\overline{MR}$ to $\overline{Q}_n$	4.0	6.5	8.0	4.0	10.0	4.0	9.0	ns

### AC Operating Requirements

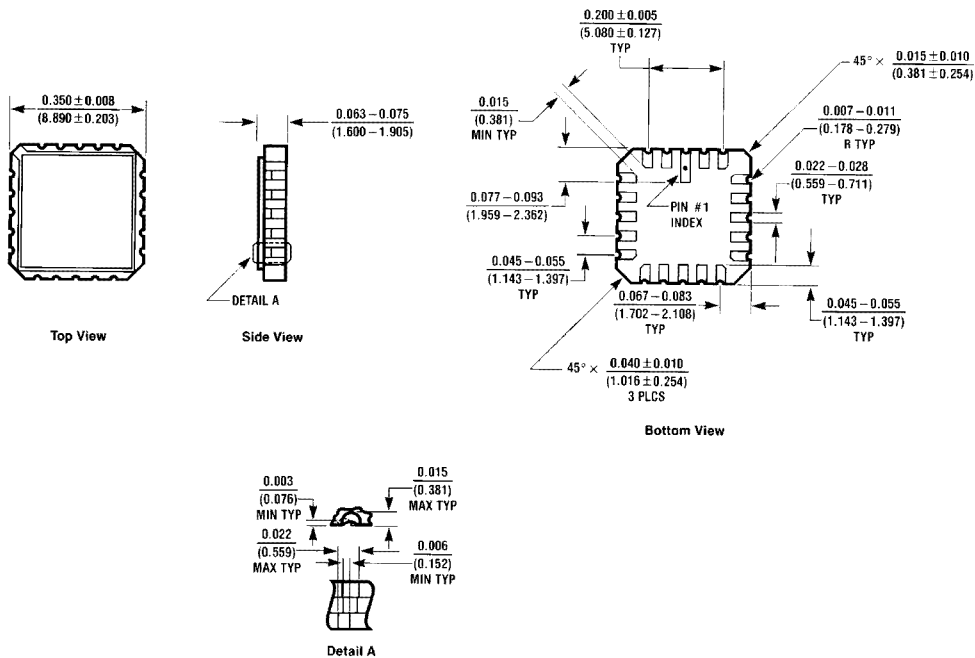
Symbol	Parameter	74F		54F		74F		Units
		T <sub>A</sub> = +25°C V <sub>CC</sub> = +5.0V		T <sub>A</sub> , V <sub>CC</sub> = Mil		T <sub>A</sub> , V <sub>CC</sub> = Com		
		Min	Max	Min	Max	Min	Max	
t <sub>s</sub> (H) t <sub>s</sub> (L)	Setup Time, HIGH or LOW D <sub>n</sub> to CP	3.0		3.0		3.0		ns
		3.0		3.0		3.0		
t <sub>h</sub> (H) t <sub>h</sub> (L)	Hold Time, HIGH or LOW D <sub>n</sub> to CP	1.0		1.0		1.0		ns
		1.0		2.0		1.0		
t <sub>w</sub> (H) t <sub>w</sub> (L)	CP Pulse Width HIGH or LOW	4.0		4.0		4.0		ns
		5.0		5.0		5.0		
t <sub>w</sub> (L)	$\overline{MR}$ Pulse Width, LOW	5.0		5.0		5.0		ns
t <sub>rec</sub>	Recovery Time, $\overline{MR}$ to CP	5.0		5.0		5.0		ns

## Ordering Information

The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:



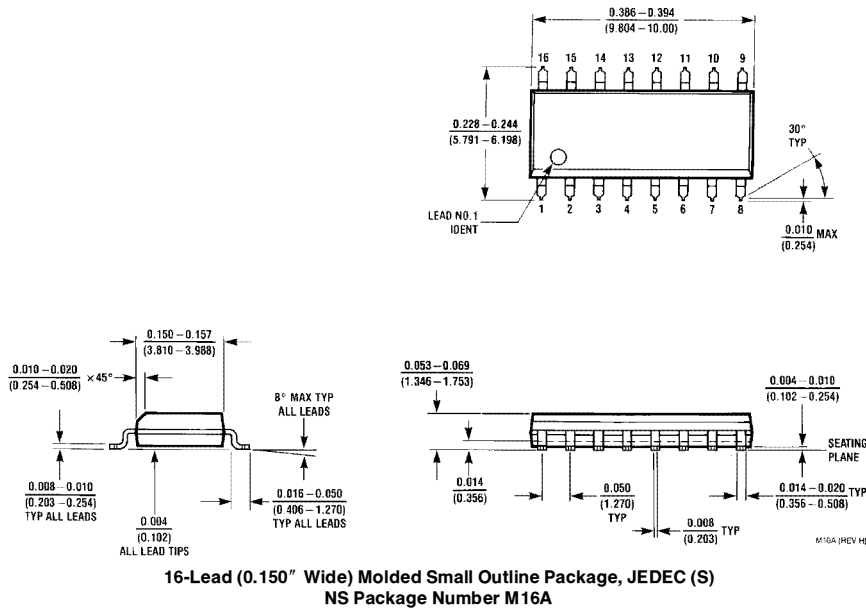
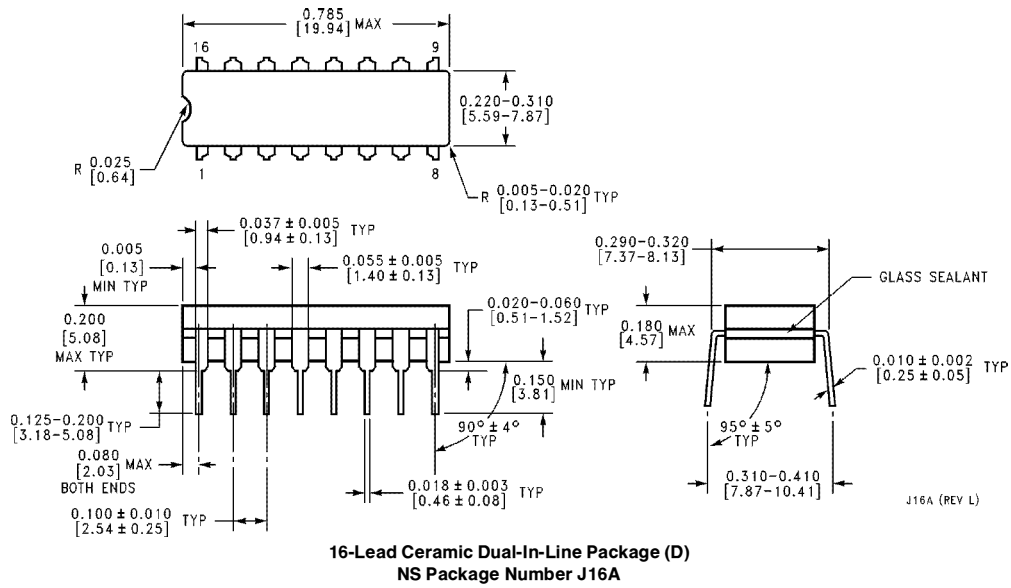
## Physical Dimensions inches (millimeters)



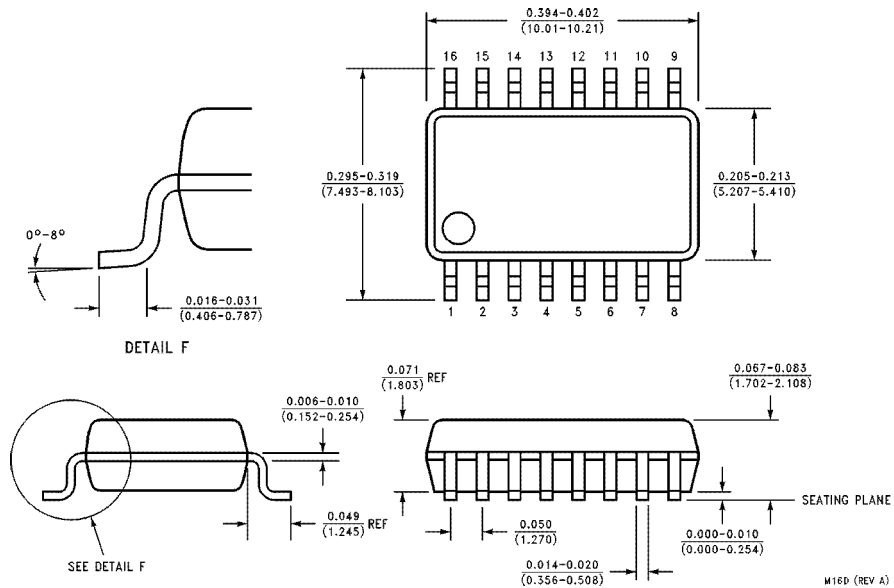
20-Terminal Ceramic Leadless Chip Carrier (L)  
NS Package Number E20A

E20A (REV D)

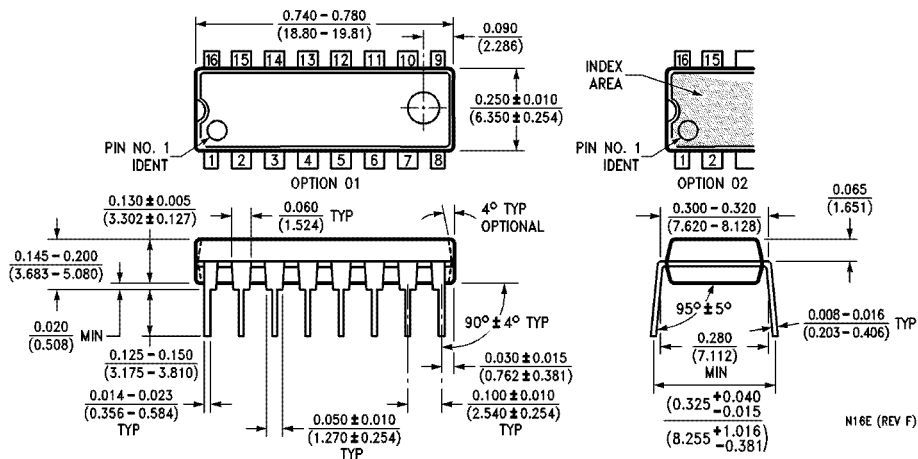
**Physical Dimensions** inches (millimeters) (Continued)



**Physical Dimensions** inches (millimeters) (Continued)

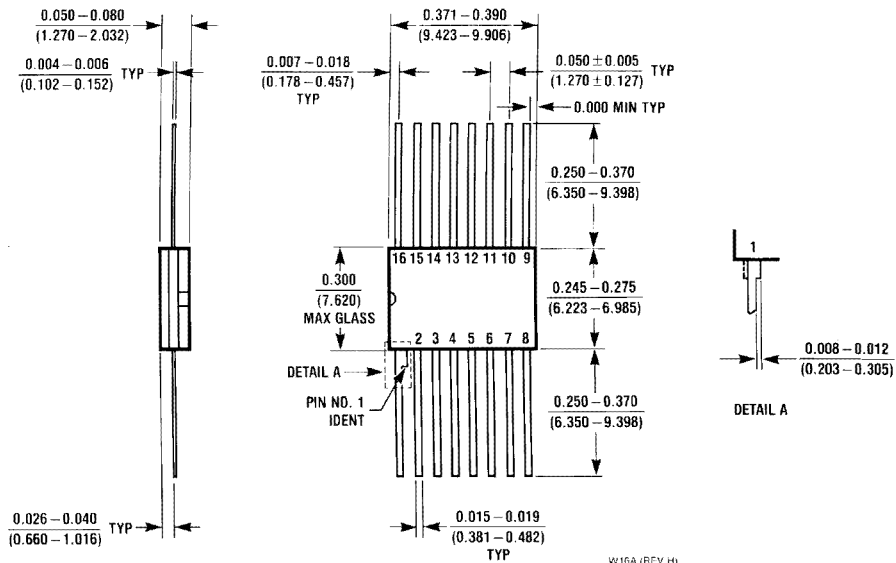


**16-Lead (0.300" Wide) Molded Small Outline Package, EIAJ (SJ)**  
NS Package Number M16D



**16-Lead (0.300" Wide) Molded Dual-In-Line Package (P)**  
NS Package Number N16E

**Physical Dimensions** inches (millimeters) (Continued)



**16 Lead Ceramic Flatpak (F)  
NS Package Number W16A**

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