

54F/74F174 Hex D Flip-Flop with Master Reset

General Description

The 'F174 is a high-speed hex D flip-flop. The device is used primarily as a 6-bit edge-triggered storage register. The information on the D inputs is transferred to storage during the LOW-to-HIGH clock transition. The device has a Master Reset to simultaneously clear all flip-flops.

Features

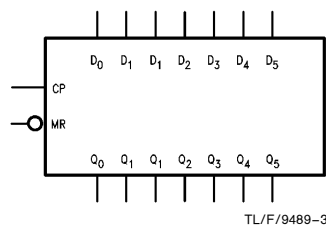
- Edge-triggered D-type inputs
- Buffered positive edge-triggered clock
- Asynchronous common reset
- Guaranteed 4000V minimum ESD protection

Commercial	Military	Package Number	Package Description
74F174PC		N16E	16-Lead (0.300" Wide) Molded Dual-In-Line
	54F174DM (Note 2)	J16A	16-Lead Ceramic Dual-In-Line
74F174SC (Note 1)		M16A	16-Lead (0.150" Wide) Molded Small Outline, JEDEC
74F174SJ (Note 1)		M16D	16-Lead (0.300" Wide) Molded Small Outline, EIAJ
	54F174FM (Note 2)	W16A	16-Lead Cerpack
	54F174LM (Note 2)	E20A	20-Lead Ceramic Leadless Chip Carrier, Type C

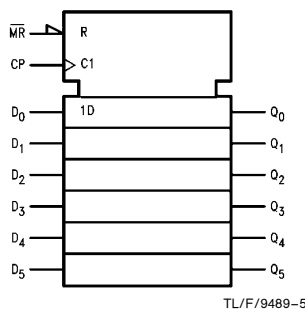
Note 1: Devices also available in 13" reel. Use Suffix = SCX and SJX.

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

Logic Symbols

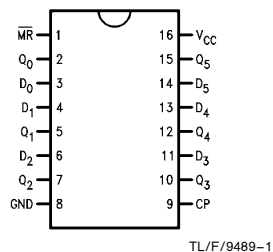


IEEE/IEC

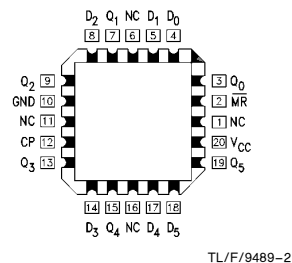


Connection Diagrams

Pin Assignment for DIP, SOIC and Flatpak



Pin Assignment for LCC



TRI-STATE® is a registered trademark of National Semiconductor Corporation.

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_5	Data Inputs	1.0/1.0	20 μA / -0.6 mA
CP	Clock Pulse Input (Active Rising Edge)	1.0/1.0	20 μA / -0.6 mA
$\overline{MR}$	Master Reset Input (Active LOW)	1.0/1.0	20 μA / -0.6 mA
Q_0-Q_5	Outputs	50/33.3	-1 mA/20 mA

Functional Description

The 'F174 consists of six edge-triggered D flip-flops with individual D inputs and Q outputs. The Clock (CP) and Master Reset ($\overline{MR}$) are common to all flip-flops. Each D input's state is transferred to the corresponding flip-flop's output following the LOW-to-HIGH Clock (CP) transition. A LOW input to the Master Reset ($\overline{MR}$) will force all outputs LOW independent of Clock or Data inputs. The 'F174 is useful for applications where the true output only is required and the Clock and Master Reset are common to all storage elements.

Truth Table

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

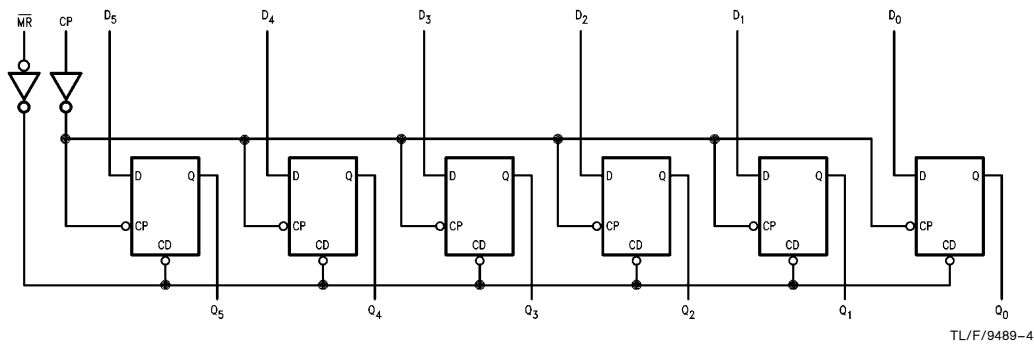
H = HIGH Voltage Level

L = LOW Voltage Level

X = Immaterial

 = 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 _{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} 74F 10% V _{CC} 74F 5% V _{CC}	2.5 2.5 2.7		V	Min	I _{OH} = −1 mA I _{OH} = −1 mA I _{OH} = −1 mA
V _{OL}	Output LOW Voltage	54F 10% V _{CC} 74F 10% V _{CC}		0.5 0.5	V	Min	I _{OL} = 20 mA I _{OL} = 20 mA
I _{IH}	Input HIGH Current	54F 74F		20.0 5.0	μA	Max	V _{IN} = 2.7V
I _{BVI}	Input HIGH Current Breakdown Test	54F 74F		100 7.0	μA	Max	V _{IN} = 7.0V
I _{CEX}	Output HIGH Leakage Current	54F 74F		250 50	μA	Max	V _{OUT} = V _{CC}
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 _{OS}	Output Short-Circuit Current		−60	−150	mA	Max	V _{OUT} = 0V
I _{CCH}	Power Supply Current		30	45	mA	Max	CP =  D _n = MR = HIGH
I _{CCL}	Power Supply Current		30	45	mA	Max	V _O = LOW

AC Electrical Characteristics

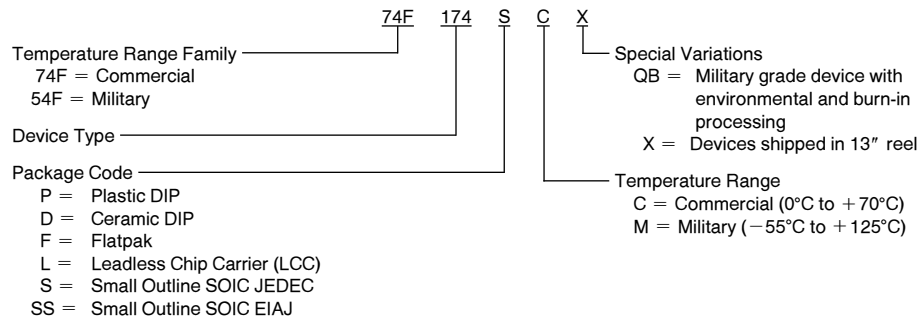
Symbol	Parameter	74F			54F		74F		Units
		T _A = +25°C V _{CC} = +5.0V C _L = 50 pF			T _A , V _{CC} = Mil C _L = 50 pF		T _A , V _{CC} = Com C _L = 50 pF		
		Min	Typ	Max	Min	Max	Min	Max	
f _{max}	Maximum Clock Frequency	80			70		80		MHz
t _{PLH}	Propagation Delay	3.5	5.5	8.0	3.0	10.0	3.5	9.0	ns
t _{PHL}	CP to Q _n	4.0	7.0	10.0	4.0	12.0	4.0	11.0	
t _{PHL}	Propagation Delay MR to Q _n	5.0	10.0	14.0	5.0	16.0	5.0	15.0	ns

AC Operating Requirements

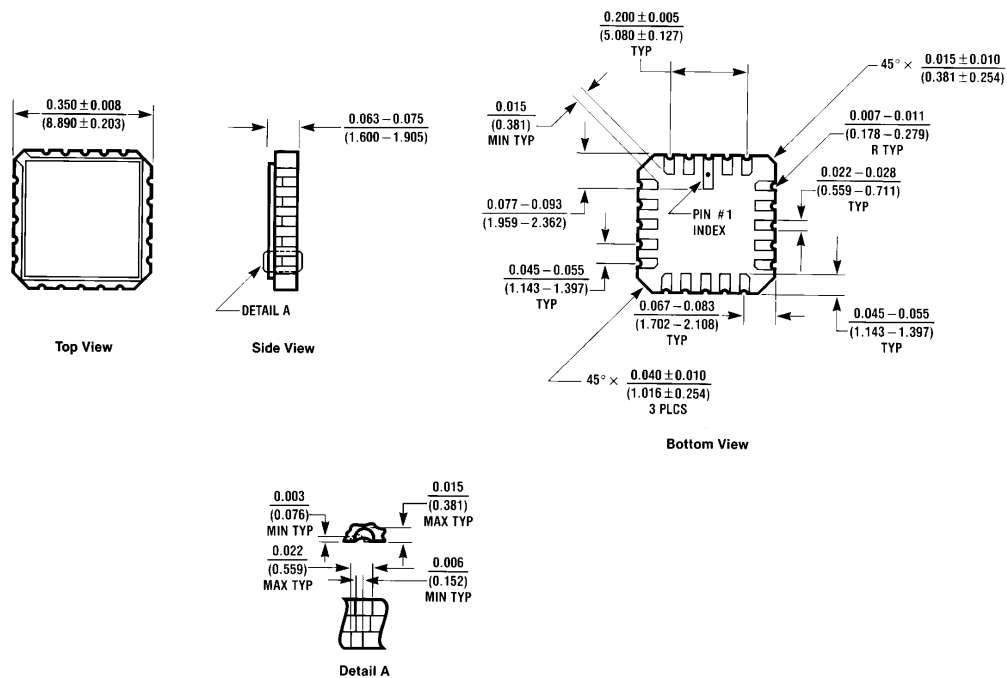
Symbol	Parameter	74F		54F		74F		Units
		$T_A = +25^{\circ}\text{C}$ $V_{CC} = +5.0\text{V}$		$T_A, V_{CC} = \text{Mil}$		$T_A, V_{CC} = \text{Com}$		
		Min	Max	Min	Max	Min	Max	
$t_s(\text{H})$	Setup Time, HIGH or LOW	4.8		5.0		4.8		ns
$t_s(\text{L})$	D_n to CP	4.0		5.0		4.0		
$t_h(\text{H})$	Hold Time, HIGH or LOW	0		2.0		0		ns
$t_h(\text{L})$	D_n to CP	0		2.0		0		
$t_w(\text{H})$	CP Pulse Width	4.0		5.0		4.0		ns
$t_w(\text{L})$	HIGH or LOW	6.0		7.5		6.0		
$t_w(\text{L})$	$\overline{\text{MR}}$ Pulse Width, LOW	5.0		6.5		5.0		ns
t_{rec}	Recovery Time, $\overline{\text{MR}}$ to CP	5.0		6.0		5.0		

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:

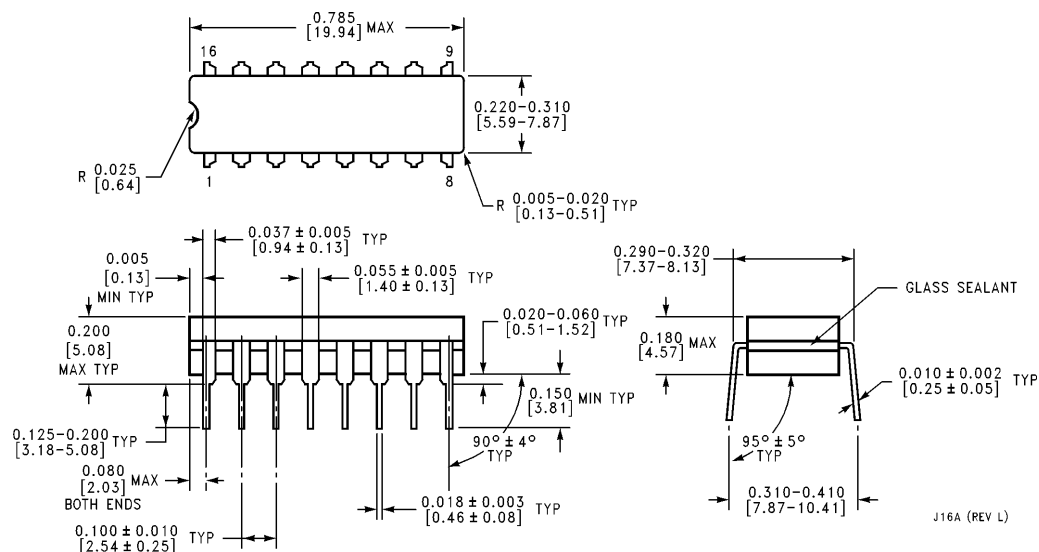


Physical Dimensions inches (millimeters)

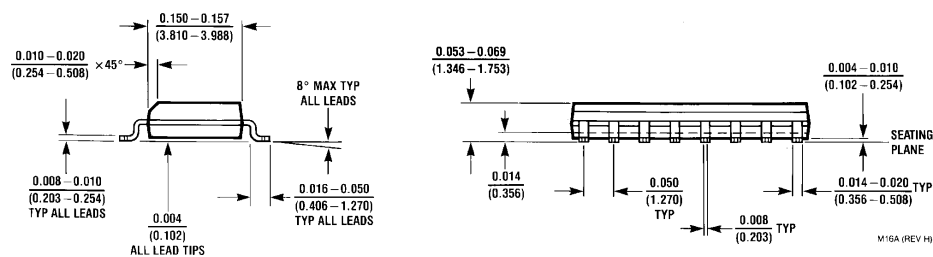
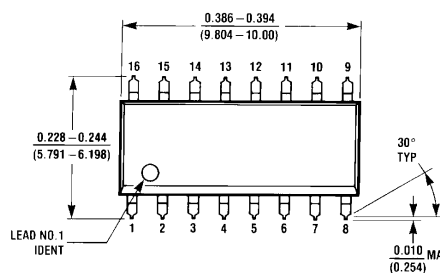


**20-Terminal Ceramic Leadless Chip Carrier (L)
NS Package Number E20A**

E20A (REV D)

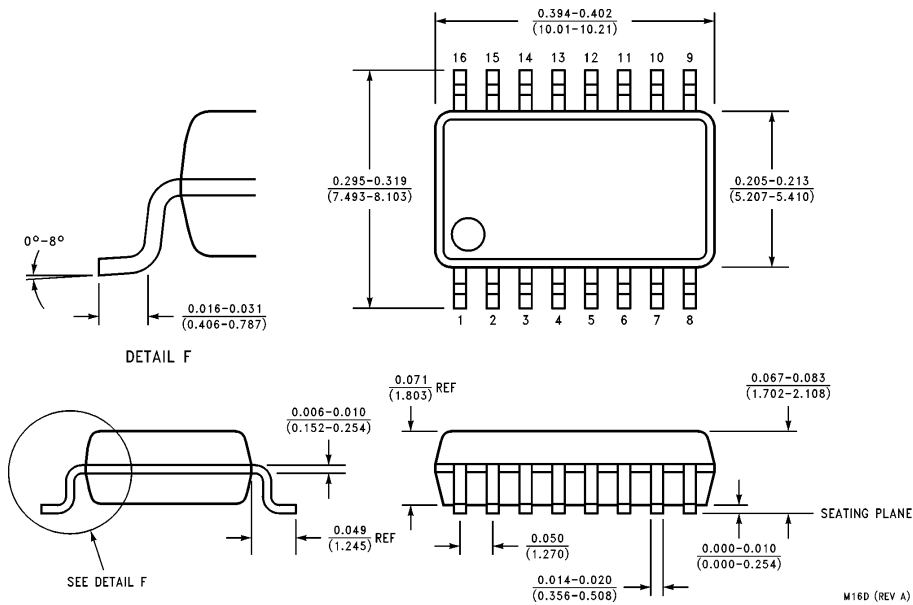
Physical Dimensions inches (millimeters) (Continued)

16-Lead Ceramic Dual-In-Line Package (D)
NS Package Number J16A

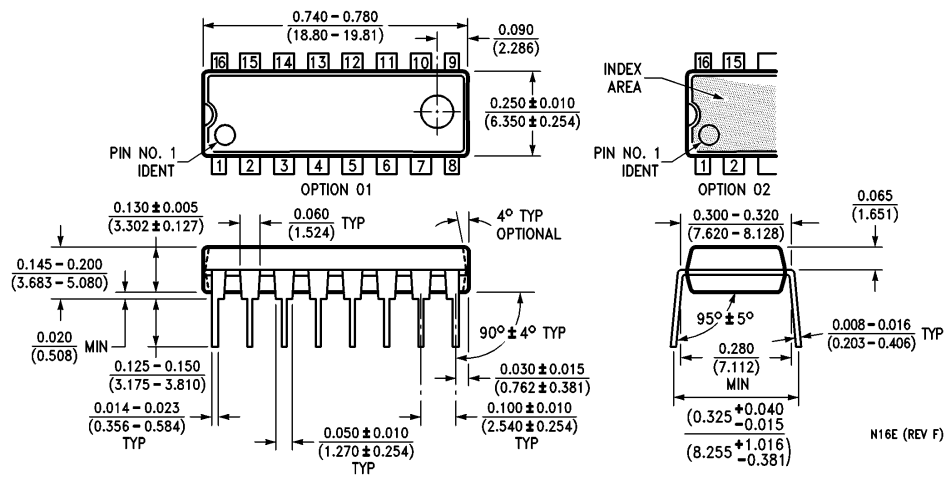


**16-Lead (0.150" Wide) Molded Small Outline Package, JEDEC (S)
NS Package Number M16A**

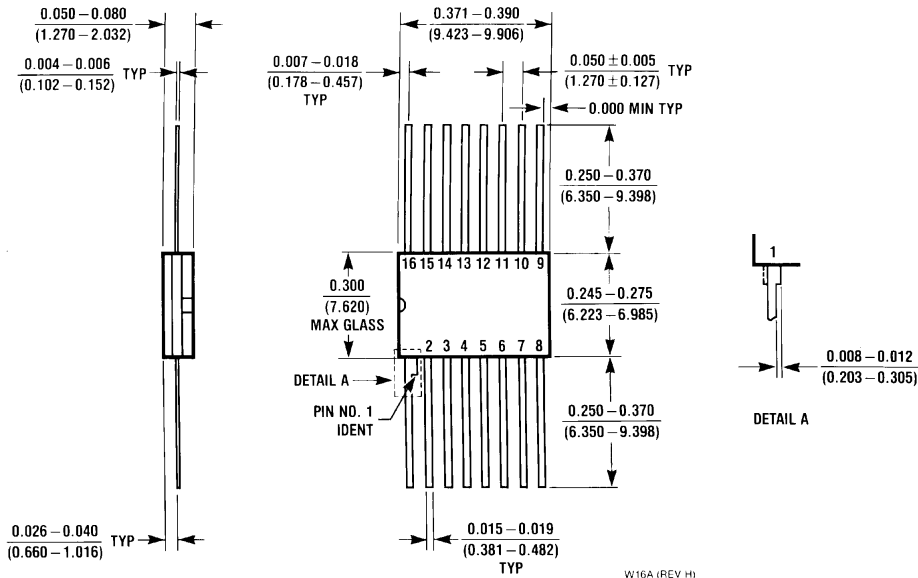
Physical Dimensions inches (millimeters) (Continued)



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

LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



National Semiconductor Corporation
2900 Semiconductor Drive
P.O. Box 58090
Santa Clara, CA 95052-8090
Tel: (408) 272-9959
TWX: (910) 339-9240

National Semiconductor GmbH
Livry-Gargan-Str. 10
D-82256 Fürstenfeldbruck
Germany
Tel: (81-41) 35-0
Telex: 527849
Fax: (81-41) 35-1

National Semiconductor Japan Ltd.
Sumitomo Chemical
Engineering Center
Bldg. 7F
1-7-1, Nakase, Mihama-Ku
Chiba-City,
Chiba Prefecture 261
Tel: (043) 299-2300
Fax: (043) 299-2500

National Semiconductor Hong Kong Ltd.
13th Floor, Straight Block,
Ocean Centre, 5 Canton Rd.
Tsimshatsui, Kowloon
Hong Kong
Tel: (852) 2737-1600
Fax: (852) 2736-9960

National Semicondutores Do Brasil Ltda.
Rue Deputado Lacorda Franco
120-3A
Sao Paulo-SP
Brazil 05418-000
Tel: (55-11) 212-5066
Telex: 391-1131931 NSBR BR
Fax: (55-11) 212-1181

National Semiconductor (Australia) Pty. Ltd.
Building 16
Business Park Drive
Monash Business Park
Nottingham, Melbourne
Victoria 3168 Australia
Tel: (3) 558-9999
Fax: (3) 558-9998

National does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and National reserves the right at any time without notice to change said circuitry and specifications.