

54F/74F377 Octal D Flip-Flop with Clock Enable

General Description

The 'F377 has eight edge-triggered, D-type flip-flops with individual D inputs and Q outputs. The common buffered Clock (CP) input loads all flip-flops simultaneously, when the Clock Enable (CE) is LOW.

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. The CE input must be stable only one setup time prior to the LOW-to-HIGH clock transition for predictable operation.

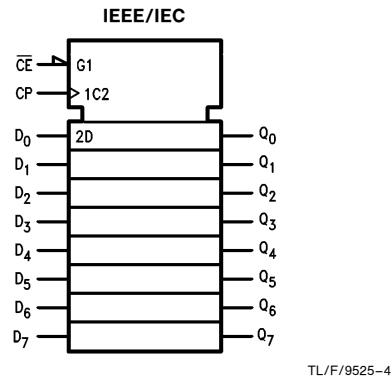
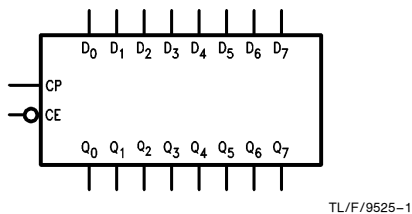
Features

- Ideal for addressable register applications
- Clock enable for address and data synchronization applications
- Eight edge-triggered D flip-flops
- Buffered common clock
- See 'F273 for master reset version
- See 'F373 for transparent latch version
- See 'F374 for TRI-STATE® version
- Guaranteed 4000V minimum ESD protection

Commercial	Military	Package Number	Package Description
74F377PC		N20A	20-Lead (0.300" Wide) Molded Dual-In-Line
	54F377DM (QB)	J20A	20-Lead Ceramic Dual-In-Line
74F377SC (Note 1)		M20B	20-Lead (0.300" Wide) Molded Small Outline, JEDEC
74F377SJ (Note 1)		M20D	20-Lead (0.300" Wide) Molded Small Outline, EIAJ
	54F377FM (QB)	W20A	20-Lead Cerpack
	54F377LM (QB)	E20A	20-Lead Ceramic Leadless Chip Carrier, Type C

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

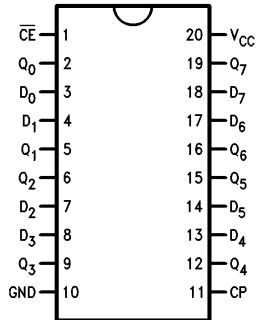
Logic Symbols



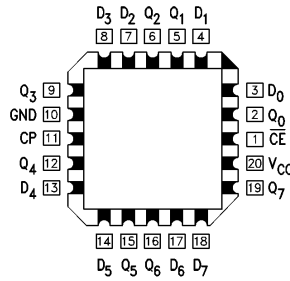
TRI-STATE® is a registered trademark of National Semiconductor Corporation.

Connection Diagrams

Pin Assignment for
DIP, SOIC and Flatpak



Pin Assignment
for LCC



TL/F/9525-3

TL/F/9525-2

Unit Loading/Fan Out

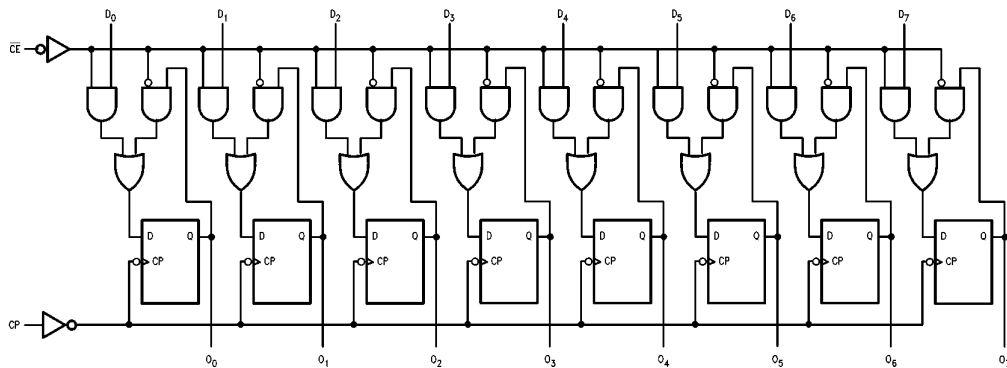
Pin Names	Description	54F/74F	
		U.L. HIGH/LOW	Input I_{IH}/I_{IL} Output I_{OH}/I_{OL}
D ₀ -D ₇	Data Inputs	1.0/1.0	20 μ A/ -0.6 mA
\overline{CE}	Clock Enable (Active LOW)	1.0/1.0	20 μ A/ -0.6 mA
CP	Clock Pulse Input	1.0/1.0	20 μ A/ -0.6 mA
Q ₀ -Q ₇	Data Outputs	50/33.3	-1 mA/20 mA

Mode Select-Function Table

Operating Mode	Inputs			Output
	CP	\overline{CE}	D _n	Q _n
Load "1"	↗	l	h	H
Load "0"	↘	l	l	L
Hold (Do Nothing)	↗	h	X	No Change
	X	H	X	No Change

H = HIGH Voltage Level
h = HIGH Voltage Level one setup time prior to the LOW-to-HIGH Clock Transition
L = LOW Voltage Level
l = LOW Voltage Level one setup time prior to the LOW-to-HIGH Clock Transition
X = Immaterial
↗ = LOW-to-HIGH Clock Transition

Logic Diagram



TL/F/9525-5

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				V		Recognized as a LOW Signal
V _{CD}	Input Clamp Diode Voltage				V	Min	I _{IN} = -18 mA
V _{OH}	Output HIGH Voltage	54F 10% V _{CC}	2.5		V	Min	I _{OH} = -1 mA I _{OH} = -1 mA I _{OH} = -1 mA
		74F 10% V _{CC}	2.5				
		74F 5% V _{CC}	2.7				
V _{OL}	Output LOW Voltage	54F 10% V _{CC}		0.5	V	Min	I _{OL} = 20 mA I _{OL} = 20 mA
		74F 10% V _{CC}		0.5			
I _{IH}	Input HIGH Current				μA	Max	V _{IN} = 2.7V
I _{BVI}	Input HIGH Current Breakdown Test				μA	Max	V _{IN} = 7.0V
I _{IL}	Input LOW Current				mA	Max	V _{IN} = 0.5V
I _{OS}	Output Short-Circuit Current	-60		-150	mA	Max	V _{OUT} = 0V
I _{CEx}	Output HIGH Leakage Current				μA	Max	V _{OUT} = V _{CC}
V _{ID}	Input Leakage Test	4.75			V	0.0	I _{ID} = 1.9 μA All Other Pins Grounded
I _{OD}	Output Leakage Circuit Current				μA	0.0	V _{IOD} = 150 mV All Other Pins Grounded
I _{CC}	Power Supply Current		35	46	mA	Max	CP =  D _n = MR = HIGH
			44	56			

AC Electrical Characteristics

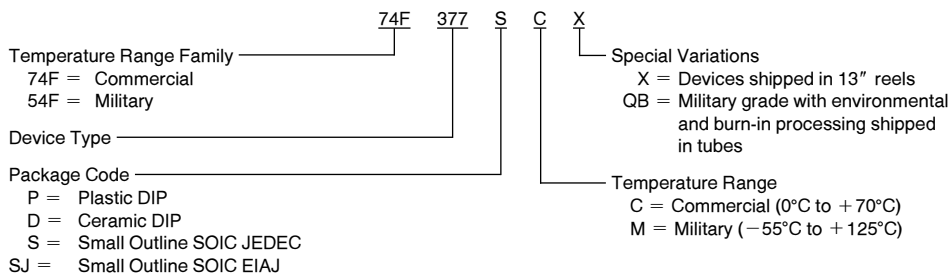
Symbol	Parameter	74F			54F		74F		Units
		T _A = +25°C V _{CC} = +5.0V C _L = 50 pF			T _A , V _{CC} = Mil C _L = 50 pF		T _A , V _{CC} = Com C _L = 50 pF		
		Min	Typ	Max	Min	Max	Min	Max	
f _{Max}	Maximum Clock Frequency	130			85		105		MHz
t _{PLH}	Propagation Delay	3.0			2.0		2.5		ns
t _{PHL}	CP to Q _n	4.0			3.0		3.5		

AC Operating Requirements

Symbol	Parameter	74F		54F		74F		Units
		T _A = +25°C V _{CC} = +5.0V		T _A , V _{CC} = Mil		T _A , V _{CC} = Com		
		Min	Max	Min	Max	Min	Max	
t _s (H)	Setup Time, HIGH or LOW	3.0		3.5		3.0		ns
t _s (L)	D _n to CP	3.5		4.0		3.5		
t _h (H)	Hold Time, HIGH or LOW	0.5		1.0		0.5		ns
t _h (L)	D _n to CP	1.0		1.0		1.0		
t _s (H)	Setup Time, HIGH or LOW	4.1		4.0		4.1		ns
t _s (L)	CE to CP	3.5		5.0		4.0		
t _h (H)	Hold Time, HIGH to LOW	0.5		1.5		0.5		ns
t _h (L)	\overline{CE} to CP	2.0		2.5		2.0		
t _w (H)	Clock Pulse Width,	6.0		5.0		6.0		ns
t _w (L)	HIGH or LOW	6.0		5.0		6.0		

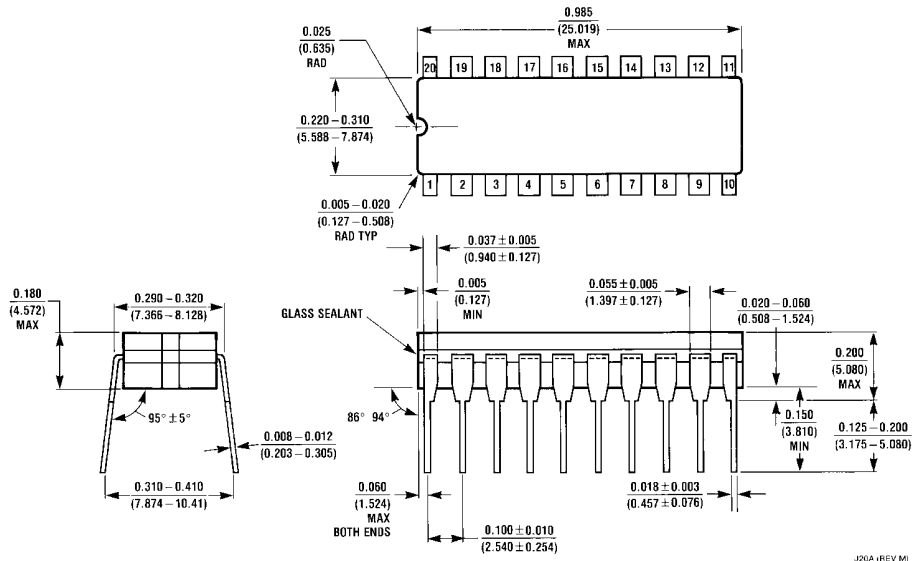
Ordering Information

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

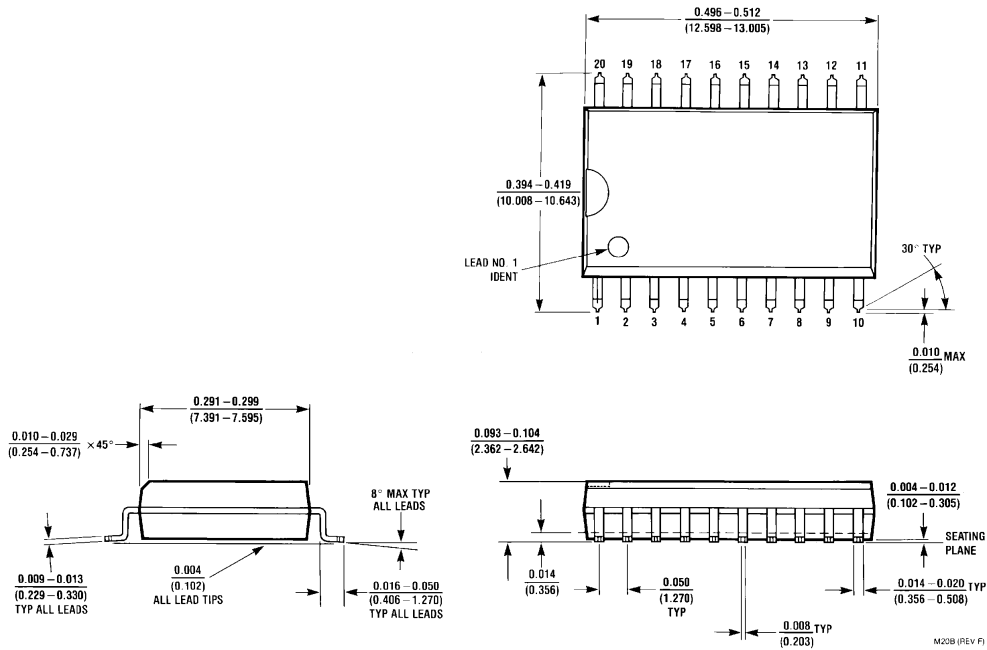




Physical Dimensions inches (millimeters)

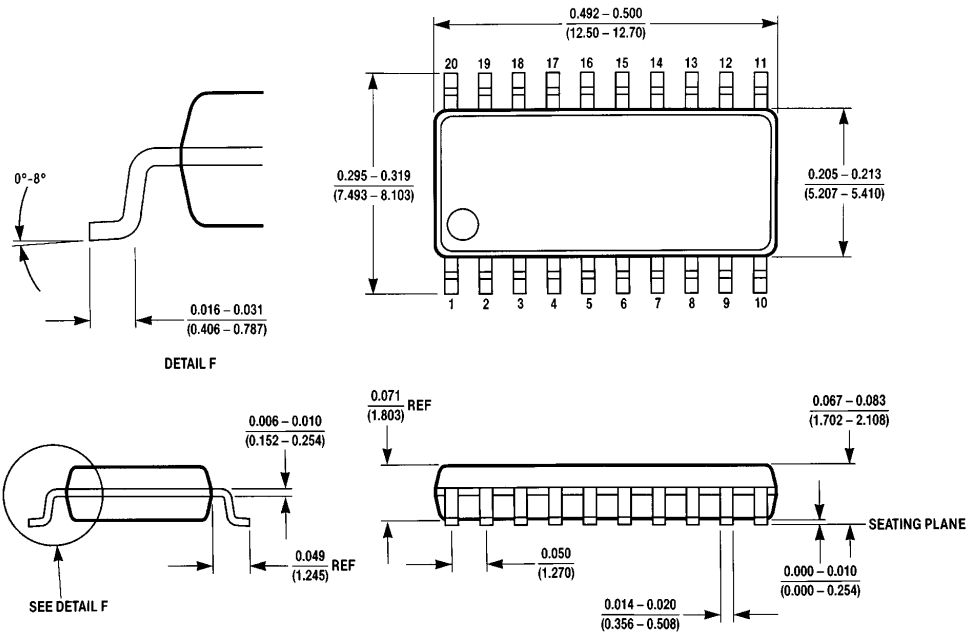


20-Lead Ceramic Dual-In-Line Package (D)
NS Package Number J20A



20-Lead (0.300" Wide) Molded Small Outline Package, JEDEC (S)
NS Package Number M20B

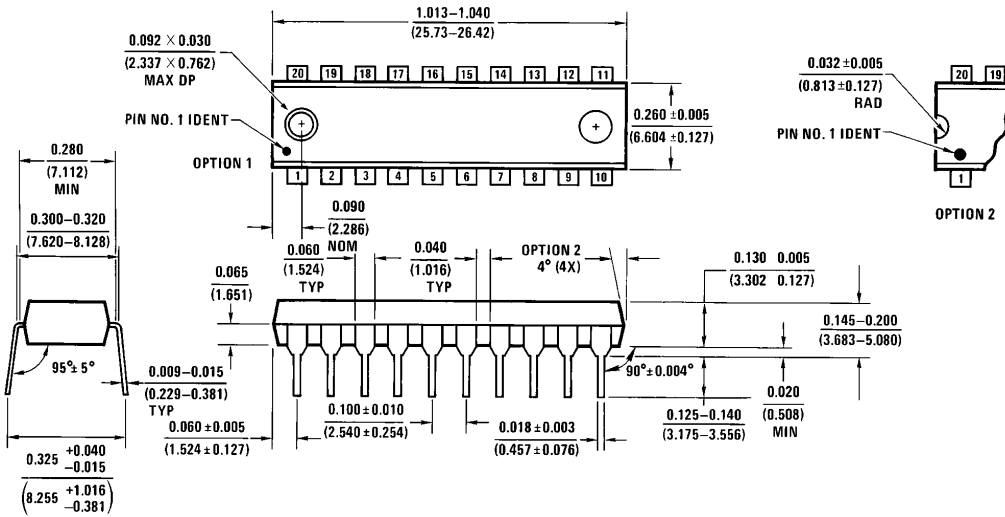
Physical Dimensions inches (millimeters) (Continued)



**20-Lead (0.300" Wide) Molded Small Outline Package, EIAJ (SJ)
NS Package Number M20D**

M20D (REV A)

Physical Dimensions inches (millimeters) (Continued)



**20-Lead (0.300" Wide) Molded Dual-In-Line Package (P)
NS Package Number N20A**

N20A (REV G)

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: (1800) 272-9959
TWX: (910) 339-9240

National Semiconductor GmbH
Livny-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,
Ciba 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 Brazil 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.