National Semiconductor

May 1995

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 ($\overline{CE}$) 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 $\overline{CE}$ input must be stable only one setup time prior to the LOW-to-HIGH clock transition for predictable operation.

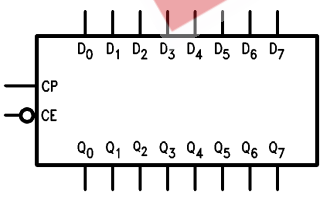
Features

- 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



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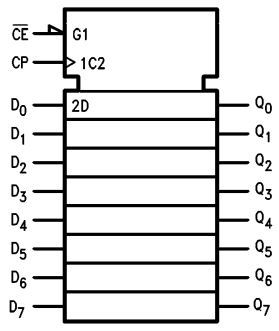
IEEE/IEC



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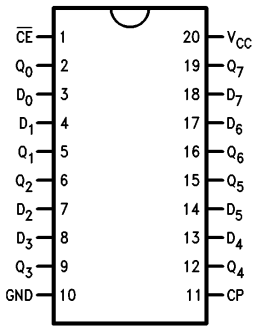
  RRD-B30M75/Printed in U. S. A.

Connection Diagrams

Pin Assignment for DIP, SOIC and Flatpak



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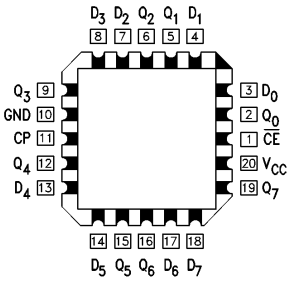
Pin Assignment for LCC



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Unit Loading/Fan Out

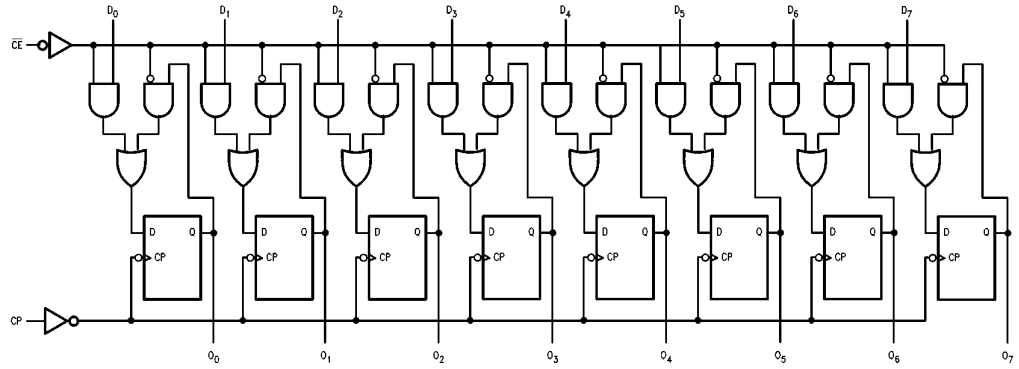
Pin Names	Description	54F/74F	
		U.L. HIGH/LOW	Input I_{IH}/I_{IL} Output I_{OH}/I_{OL}
D_0–D_7	Data Inputs	1.0/1.0	20 μA/−0.6 mA
$\overline{CE}$	Clock Enable (Active LOW)	1.0/1.0	20 μA/−0.6 mA
CP	Clock Pulse Input	1.0/1.0	20 μA/−0.6 mA
Q_0–Q_7	Data Outputs	50/33.3	−1 mA/20 mA

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



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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
	74F 10% V_{CC}	2.5					I_{OH} = −1 mA
	74F 5% V_{CC}	2.7					I_{OH} = −1 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} = 20 mA
I_{IH}	Input HIGH Current			5.0	μA	Max	V_{IN} = 2.7V
I_{BVI}	Input HIGH Current Breakdown Test			7.0	μA	Max	V_{IN} = 7.0V
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_{CEX}	Output HIGH Leakage Current			50	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			3.75	μA	0.0	V_{IOD} = 150 mV All Other Pins Grounded
I_{CCH}	Power Supply Current		35	46	mA	Max	CP = ⌐
I_{CCL}			44	56			D_n = $\overline{MR}$ = HIGH

AC Electrical Characteristics

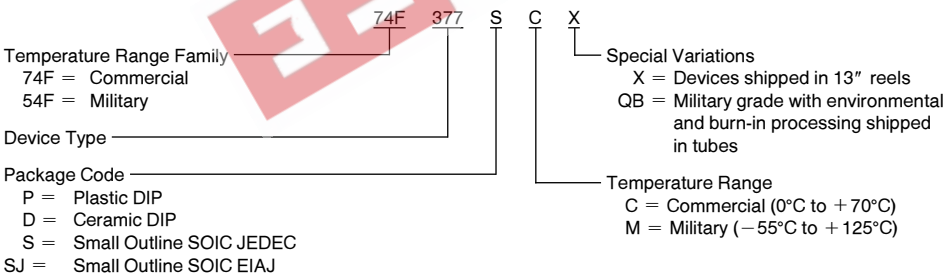
Symbol	Parameter	74F $T_A = +25°C$, $V_{CC} = +5.0V$, $C_L = 50$ pF			54F T_A, V_{CC} = Mil, $C_L = 50$ pF		74F T_A, V_{CC} = Com, $C_L = 50$ pF		Units
		Min	Typ	Max	Min	Max	Min	Max	
f_{Max}	Maximum Clock Frequency	130			85		105		MHz
t_{PLH} t_{PHL}	Propagation Delay CP to Q_n	3.0 4.0		7.0 9.0	2.0 3.0	8.5 10.5	2.5 3.5	7.5 9.0	ns

AC Operating Requirements

Symbol	Parameter	74F $T_A = +25°C$, $V_{CC} = +5.0V$		54F T_A, V_{CC} = Mil		74F T_A, V_{CC} = Com		Units
		Min	Max	Min	Max	Min	Max	
$t_s(H)$ $t_s(L)$	Setup Time, HIGH or LOW D_n to CP	3.0 3.5		3.5 4.0		3.0 3.5		ns
$t_h(H)$ $t_h(L)$	Hold Time, HIGH or LOW D_n to CP	0.5 1.0		1.0 1.0		0.5 1.0		ns
$t_s(H)$ $t_s(L)$	Setup Time, HIGH or LOW $\overline{CE}$ to CP	4.1 3.5		4.0 5.0		4.1 4.0		ns
$t_h(H)$ $t_h(L)$	Hold Time, HIGH to LOW $\overline{CE}$ to CP	0.5 2.0		1.5 2.5		0.5 2.0		ns
$t_w(H)$ $t_w(L)$	Clock Pulse Width, HIGH or LOW	6.0 6.0		5.0 5.0		6.0 6.0		ns

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:

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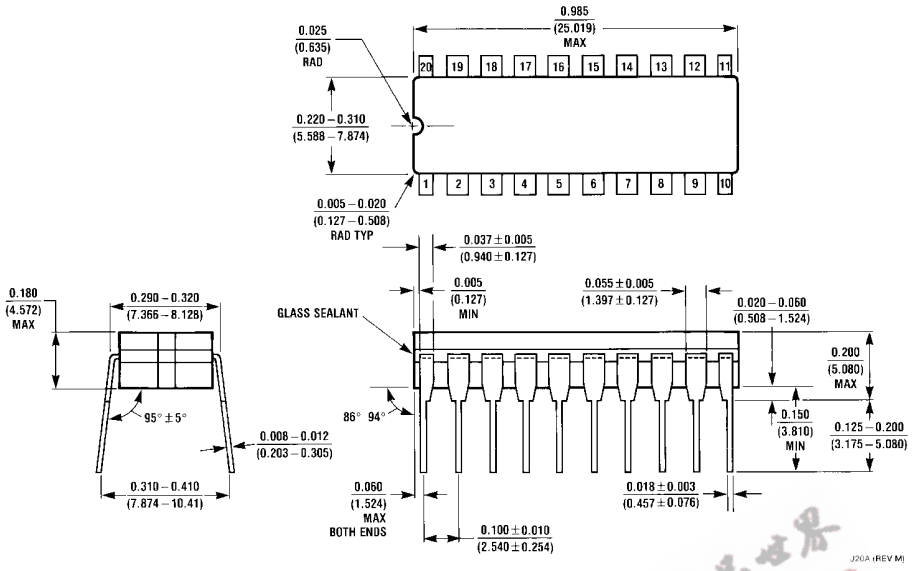
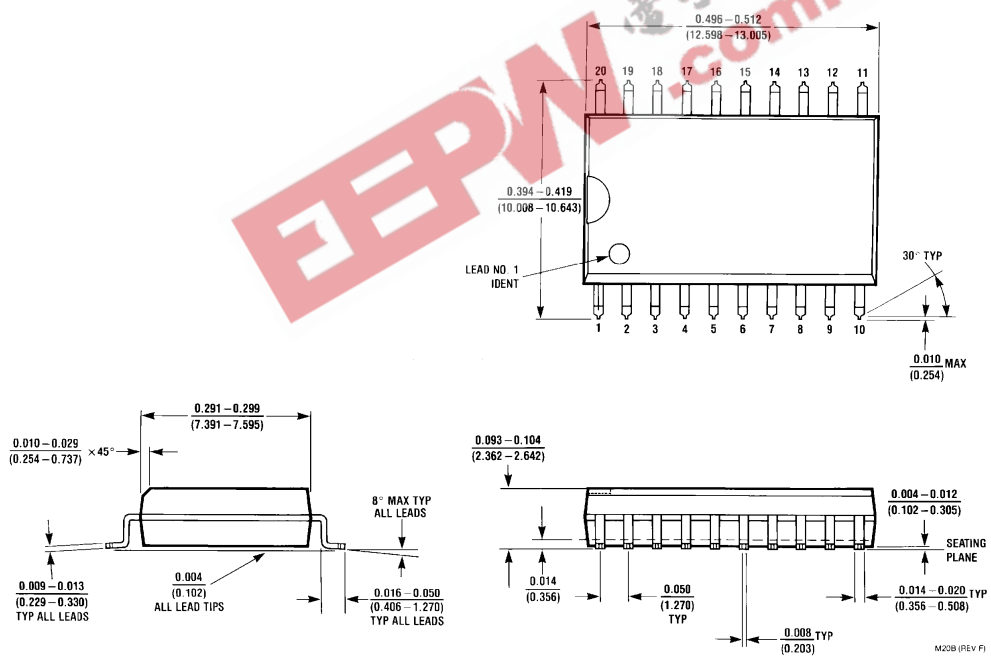
Physical Dimensions inches (millimeters)

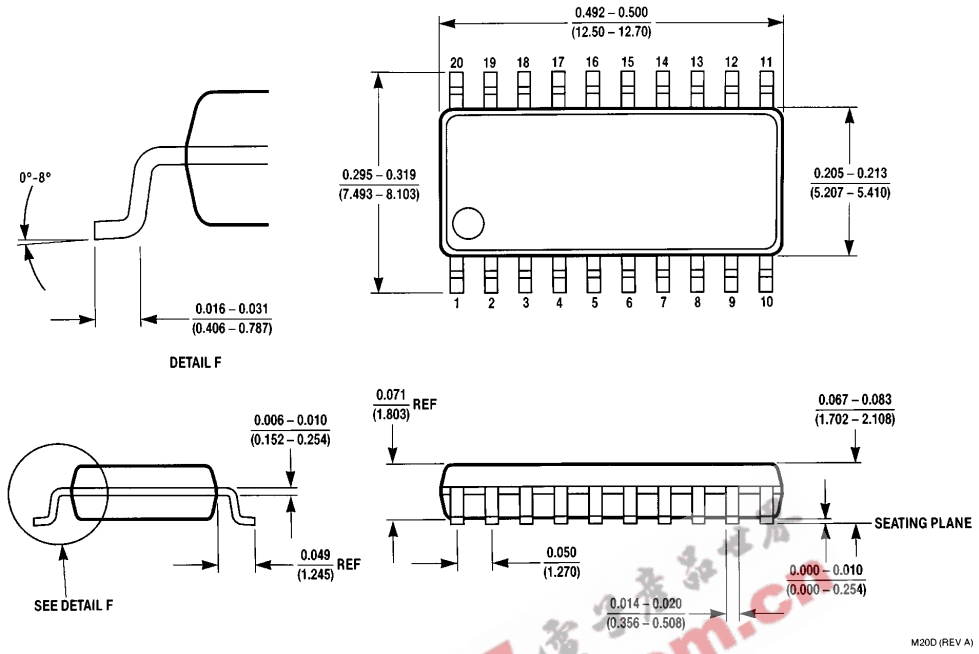


20-Lead Ceramic Dual-In-Line Package (D)
NS Package Number J20A



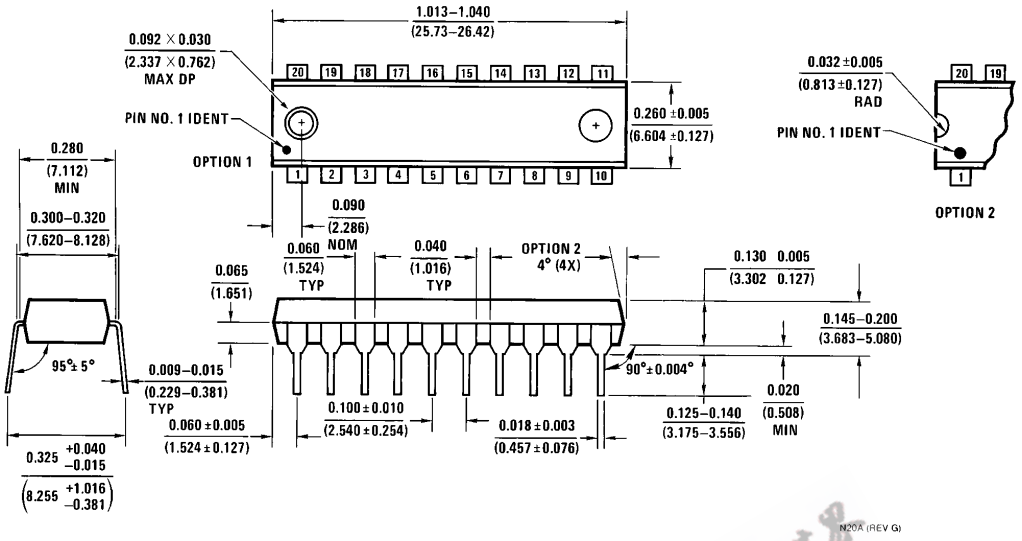
20-Lead (0.300″ Wide) Molded Small Outline Package, JEDEC (S)
NS Package Number M20B

Physical Dimensions inches (millimeters) (Continued)



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

Physical Dimensions inches (millimeters) (Continued)



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

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