

## 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.

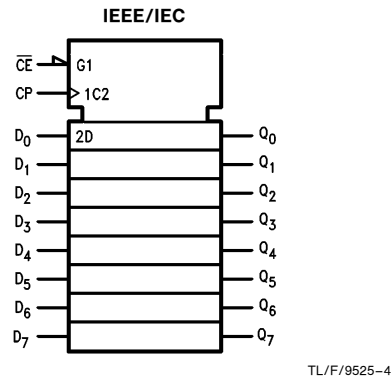
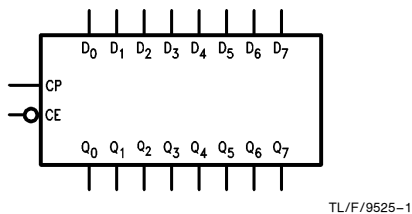
### Features

- 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.

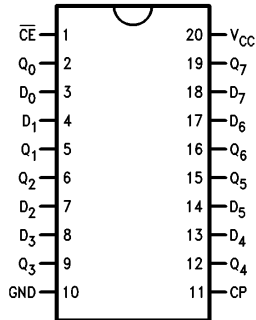
### Logic Symbols



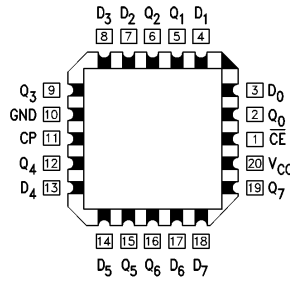
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## Connection Diagrams

Pin Assignment for  
DIP, SOIC and Flatpak



Pin Assignment  
for LCC



TL/F/9525-3

TL/F/9525-2

## Unit Loading/Fan Out

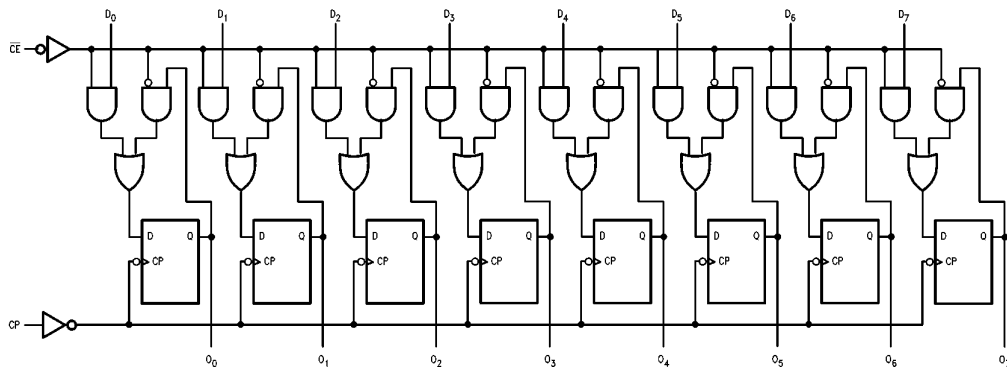
Pin Names	Description	54F/74F	
		U.L. HIGH/LOW	Input $I_{IH}/I_{IL}$ Output $I_{OH}/I_{OL}$
$D_0-D_7$	Data Inputs	1.0/1.0	20 $\mu A / -0.6$ mA
$\overline{CE}$	Clock Enable (Active LOW)	1.0/1.0	20 $\mu A / -0.6$ mA
CP	Clock Pulse Input	1.0/1.0	20 $\mu A / -0.6$ mA
$Q_0-Q_7$	Data Outputs	50/33.3	-1 mA/20 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 <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)
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 <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				V		Recognized as a LOW Signal
V <sub>CD</sub>	Input Clamp Diode Voltage				V	Min	I <sub>IN</sub> = -18 mA
V <sub>OH</sub>	Output HIGH Voltage	54F 10% V <sub>CC</sub>	2.5		V	Min	I <sub>OH</sub> = -1 mA I <sub>OH</sub> = -1 mA I <sub>OH</sub> = -1 mA
		74F 10% V <sub>CC</sub>	2.5				
		74F 5% V <sub>CC</sub>	2.7				
V <sub>OL</sub>	Output LOW Voltage	54F 10% V <sub>CC</sub>		0.5	V	Min	I <sub>OL</sub> = 20 mA I <sub>OL</sub> = 20 mA
		74F 10% V <sub>CC</sub>		0.5			
I <sub>IH</sub>	Input HIGH Current				μA	Max	V <sub>IN</sub> = 2.7V
I <sub>BVI</sub>	Input HIGH Current Breakdown Test				μA	Max	V <sub>IN</sub> = 7.0V
I <sub>IL</sub>	Input LOW Current				mA	Max	V <sub>IN</sub> = 0.5V
I <sub>OS</sub>	Output Short-Circuit Current	-60		-150	mA	Max	V <sub>OUT</sub> = 0V
I <sub>CEx</sub>	Output HIGH Leakage Current				μA	Max	V <sub>OUT</sub> = V <sub>CC</sub>
V <sub>ID</sub>	Input Leakage Test	4.75			V	0.0	I <sub>ID</sub> = 1.9 μA All Other Pins Grounded
I <sub>OD</sub>	Output Leakage Circuit Current				μA	0.0	V <sub>IOD</sub> = 150 mV All Other Pins Grounded
I <sub>CCCH</sub> I <sub>CCCL</sub>	Power Supply Current		35 44	46 56	mA	Max	CP =  D <sub>n</sub> = MR = HIGH

## AC Electrical Characteristics

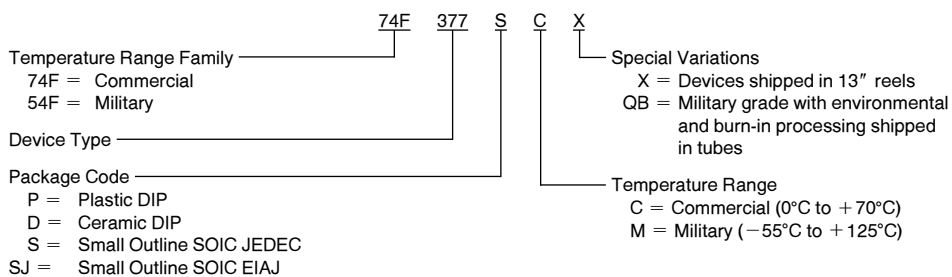
Symbol	Parameter	74F			54F		74F		Units
		T <sub>A</sub> = +25°C V <sub>CC</sub> = +5.0V C <sub>L</sub> = 50 pF			T <sub>A</sub> , V <sub>CC</sub> = Mil C <sub>L</sub> = 50 pF		T <sub>A</sub> , V <sub>CC</sub> = Com C <sub>L</sub> = 50 pF		
		Min	Typ	Max	Min	Max	Min	Max	
f <sub>Max</sub>	Maximum Clock Frequency	130			85		105		MHz
t <sub>PLH</sub>	Propagation Delay	3.0			2.0		2.5		ns
t <sub>PHL</sub>	CP to Q <sub>n</sub>	4.0			3.0		3.5		

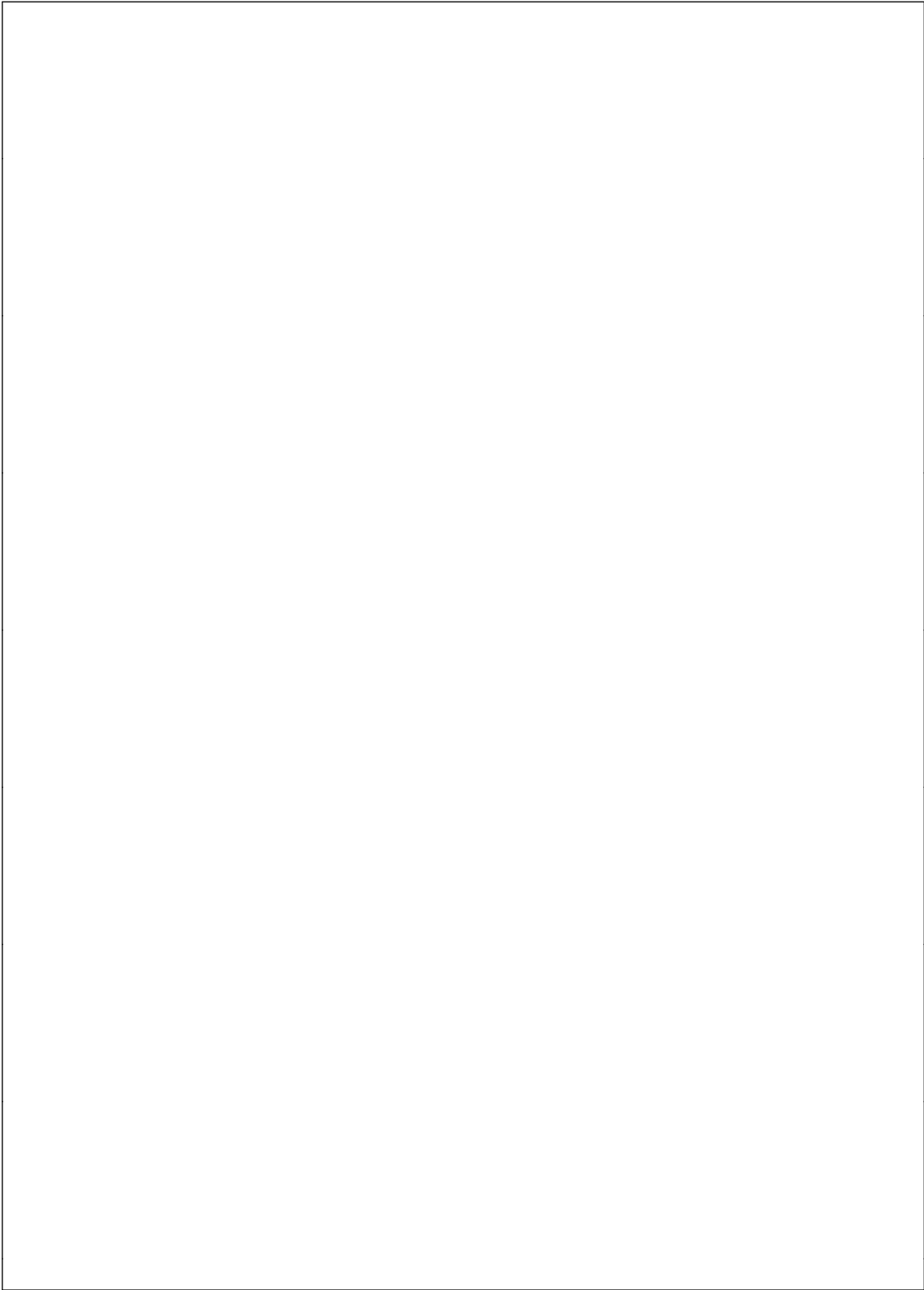
## AC Operating Requirements

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)	Setup Time, HIGH or LOW	3.0		3.5		3.0		ns
t <sub>s</sub> (L)	D <sub>n</sub> to CP	3.5		4.0		3.5		
t <sub>h</sub> (H)	Hold Time, HIGH or LOW	0.5		1.0		0.5		ns
t <sub>h</sub> (L)	D <sub>n</sub> to CP	1.0		1.0		1.0		
t <sub>s</sub> (H)	Setup Time, HIGH or LOW	4.1		4.0		4.1		ns
t <sub>s</sub> (L)	CE to CP	3.5		5.0		4.0		
t <sub>h</sub> (H)	Hold Time, HIGH to LOW	0.5		1.5		0.5		ns
t <sub>h</sub> (L)	$\overline{CE}$ to CP	2.0		2.5		2.0		
t <sub>w</sub> (H)	Clock Pulse Width, HIGH or LOW	6.0		5.0		6.0		ns
t <sub>w</sub> (L)		6.0		5.0		6.0		

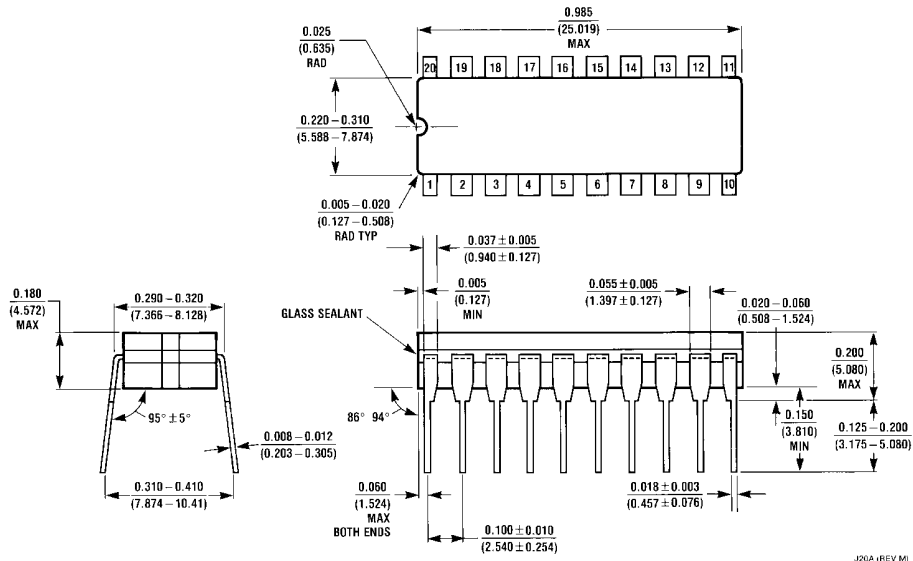
## Ordering Information

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

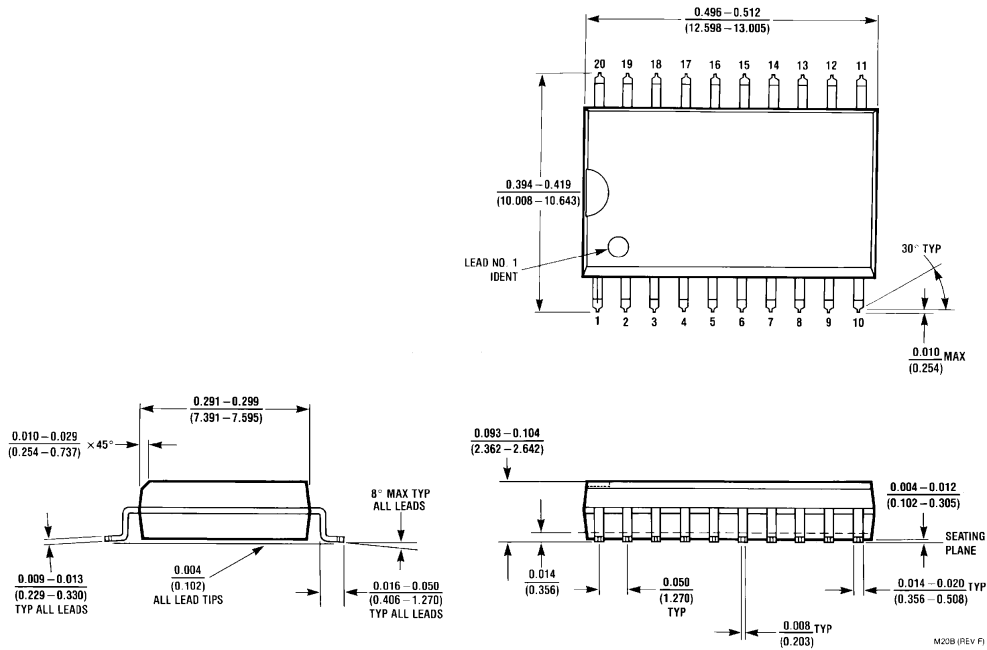




**Physical Dimensions** inches (millimeters)

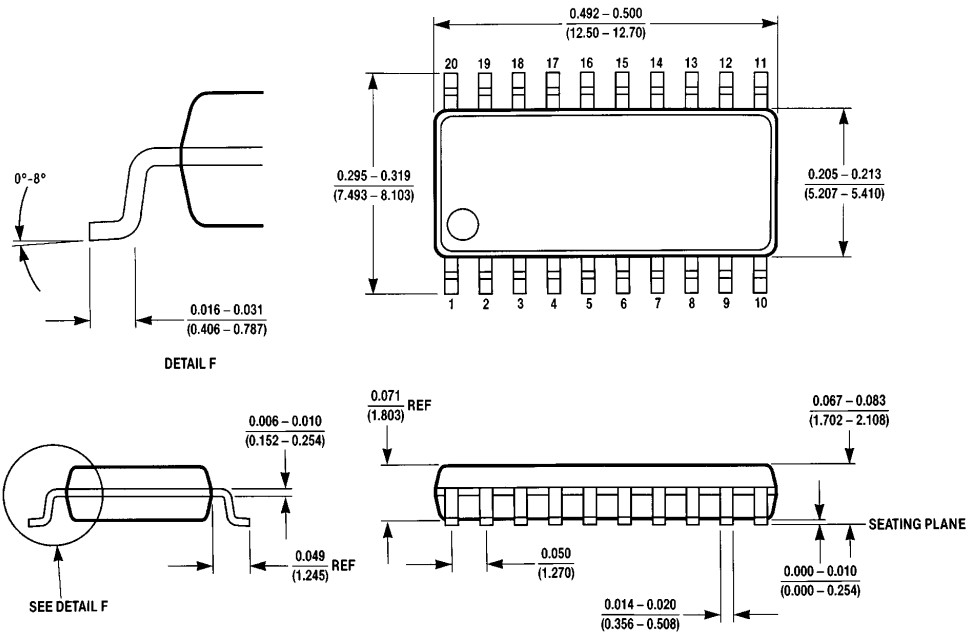


**20-Lead Ceramic Dual-In-Line Package (D)**  
**NS Package Number J20A**



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

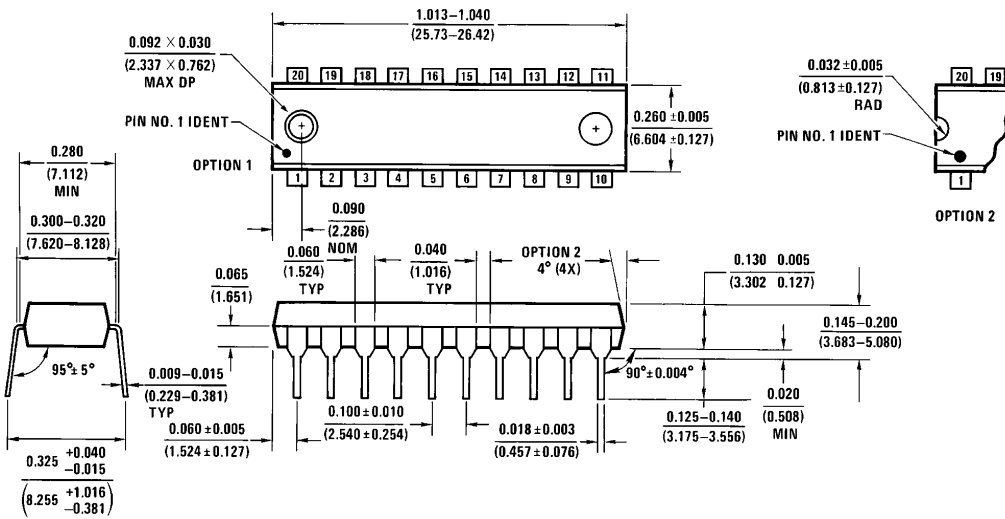
**Physical Dimensions** inches (millimeters) (Continued)



**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**

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**National Semiconductor Corporation**  
2900 Semiconductor Drive  
P.O. Box 58090  
Santa Clara, CA 95052-8090  
Tel: (800) 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

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