

## 54F/74F534 Octal D-Type Flip-Flop with TRI-STATE® Outputs

### General Description

The 'F534 is a high speed, low-power octal D-type flip-flop featuring separate D-type inputs for each flip-flop and TRI-STATE outputs for bus-oriented applications. A buffered Clock (CP) and Output Enable ( $\overline{OE}$ ) are common to all flip-flops. The 'F534 is the same as the 'F374 except that the outputs are inverted.

### Features

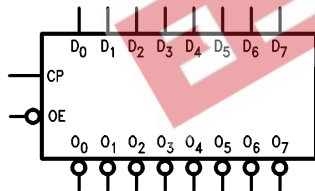
- Edge-triggered D-type inputs
- Buffered positive edge-triggered clock
- TRI-STATE outputs for bus-oriented applications
- Guaranteed 4000V minimum ESD protection

Commercial	Military	Package Number	Package Description
74F534PC		N20A	20-Lead (0.300" Wide) Molded Dual-In-Line
	54F534DM (Note 2)	J20A	20-Lead Ceramic Dual-In-Line
74F534SC (Note 1)		M20B	20-Lead (0.300" Wide) Molded Small Outline, JEDEC
74F534SJ (Note 1)		M20D	20-Lead (0.300" Wide) Molded Small Outline, EIAJ
	54F534FM (Note 2)	W20A	20-Lead Cerpack
	54F534LM (Note 2)	E20A	20-Lead Ceramic Leadless Chip Carrier, Type C

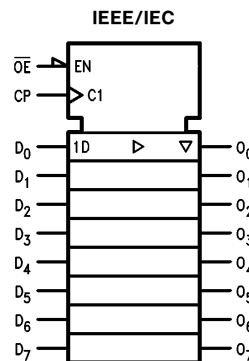
**Note 1:** Devices also available in 13" reel. Use suffix = SCX, and SJX

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

### Logic Symbols



TL/F/9549-1



TL/F/9549-5

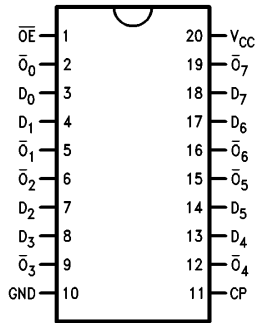
### Unit Loading/Fan Out

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
CP	Clock Pulse Input (Active Rising Edge)	1.0/1.0	20 $\mu$ A/ -0.6 mA
$\overline{OE}$	TRI-STATE Output Enable Input (Active LOW)	1.0/1.0	20 $\mu$ A/ -0.6 mA
$\overline{O_0}$ - $\overline{O_7}$	Complementary TRI-STATE Outputs	150/40(33.3)	-3 mA/24 mA (20 mA)

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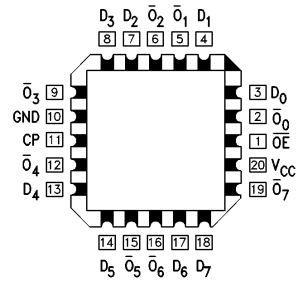
## Connection Diagrams

Pin Assignment for  
DIP, SOIC and Flatpak



TL/F/9549-2

Pin Assignment  
for LCC



TL/F/9549-3

## Functional Description

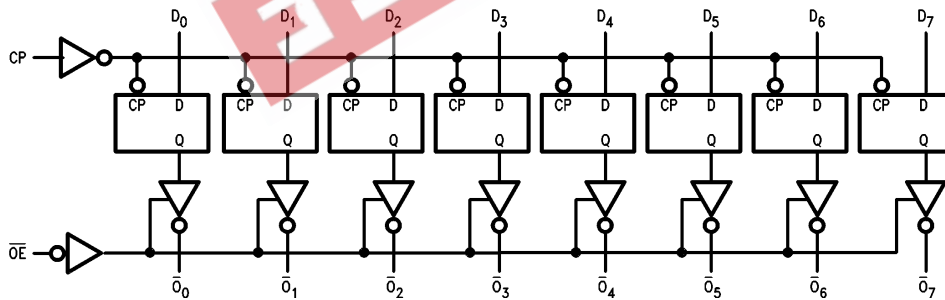
The 'F534 consists of eight edge-triggered flip-flops with individual D-type inputs and TRI-STATE complementary outputs. The buffered clock and buffered Output Enable are common to all flip-flops. The eight flip-flops will store the state of their individual D inputs that meet the setup and hold times requirements on the LOW-to-HIGH clock (CP) transition. With the Output Enable ( $\overline{OE}$ ) LOW, the contents of the eight flip-flops are available at the outputs. When the  $\overline{OE}$  is HIGH, the outputs go to the high impedance state. Operation of the  $\overline{OE}$  input does not affect the state of the flip-flops.

Function Table

Inputs			Output
CP	OE	D	$\overline{O}$
	L	H	L
	L	L	H
L	L	X	$\overline{O}_0$
X	H	X	Z

H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Immaterial  
 = LOW-to-HIGH Clock Transition  
Z = High Impedance  
 $\overline{O}_0$  = Value stored from previous clock cycle

## Logic Diagram



TL/F/9549-4

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			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> 54F 10% V <sub>CC</sub> 74F 10% V <sub>CC</sub> 74F 10% V <sub>CC</sub> 74F 5% V <sub>CC</sub> 74F 5% V <sub>CC</sub>	2.5 2.4 2.5 2.4 2.7 2.7		V	Min	I <sub>OH</sub> = -1 mA I <sub>OH</sub> = -3 mA I <sub>OH</sub> = -1 mA I <sub>OH</sub> = -3 mA I <sub>OH</sub> = -1 mA I <sub>OH</sub> = -3 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> = 24 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>IOD</sub> = 1.50 μA All Other Pins Grounded
I <sub>IL</sub>	Input LOW Current			-0.6	mA	Max	V <sub>IN</sub> = 0.5V
I <sub>OZH</sub>	Output Leakage Current			50	μA	Max	V <sub>OUT</sub> = 2.7V
I <sub>OZL</sub>	Output Leakage Current			-50	μA	Max	V <sub>OUT</sub> = 0.5V
I <sub>OS</sub>	Output Short-Circuit Current			-60	mA	Max	V <sub>OUT</sub> = 0V
I <sub>ZZ</sub>	Bus Drainage Test			500	μA	0.0V	V <sub>OUT</sub> = 5.25V
I <sub>CCZ</sub>	Power Supply Current		55	86	mA	Max	V <sub>O</sub> = HIGH Z

## AC Electrical Characteristics

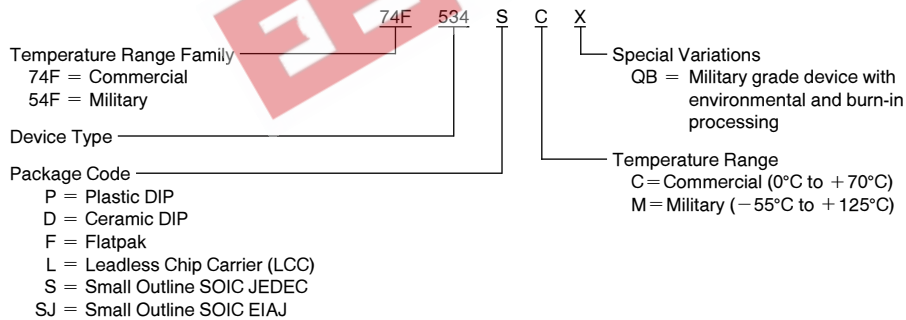
Symbol	Parameter	74F			54F		74F		Units
		T <sub>A</sub> = +25°C V <sub>CC</sub> = +5.0V C <sub>L</sub> = 50 pF			T <sub>A</sub> , V <sub>CC</sub> = Mil C <sub>L</sub> = 50 pF		T <sub>A</sub> , V <sub>CC</sub> = Com C <sub>L</sub> = 50 pF		
		Min	Typ	Max	Min	Max	Min	Max	
f <sub>max</sub>	Maximum Clock Frequency	100			60		70		MHz
t <sub>PLH</sub>	Propagation Delay	4.0	6.5	8.5	4.0	10.5	4.0	10.0	ns
t <sub>PHL</sub>	CP to $\bar{O}_n$	4.0	6.5	8.5	4.0	11.0	4.0	10.0	
t <sub>PZH</sub>	Output Enable Time	2.0	9.0	11.5	2.0	14.0	2.0	12.5	ns
t <sub>PZL</sub>		2.0	5.8	7.5	2.0	10.0	2.0	8.5	
t <sub>PHZ</sub>	Output Disable Time	1.5	5.3	7.0	1.5	8.0	1.5	8.0	ns
t <sub>PLZ</sub>		1.5	4.3	5.5	1.5	7.5	1.5	6.5	

## AC Operating Requirements

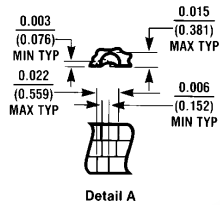
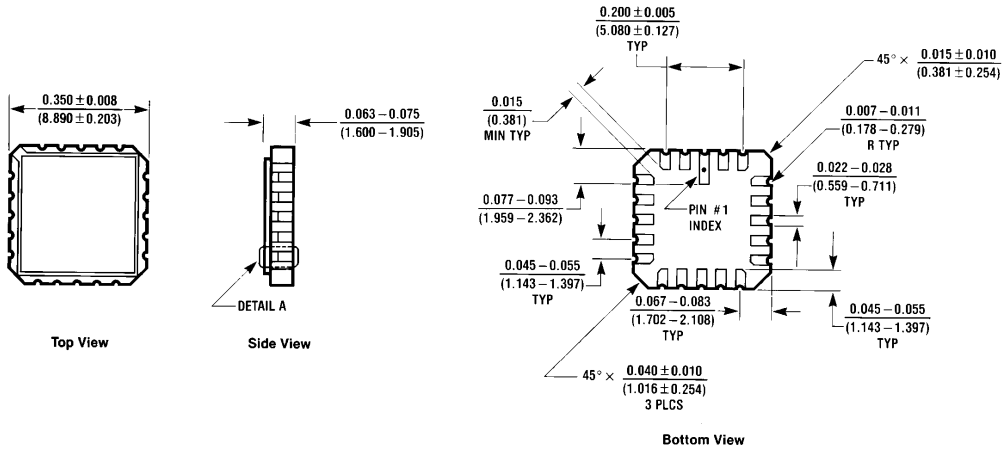
Symbol	Parameter	74F		54F		74F		Units
		T <sub>A</sub> = +25°C V <sub>CC</sub> = +5.0V		T <sub>A</sub> , V <sub>CC</sub> = Mil		T <sub>A</sub> , V <sub>CC</sub> = Com		
		Min	Max	Min	Max	Min	Max	
t <sub>s</sub> (H)	Setup Time, HIGH or LOW	2.0		2.0		2.0		ns
t <sub>s</sub> (L)	D <sub>n</sub> to CP	2.0		2.5		2.0		
t <sub>h</sub> (H)	Hold Time, HIGH or LOW	2.0		2.0		2.0		ns
t <sub>h</sub> (L)	D <sub>n</sub> to CP	2.0		2.5		2.0		
t <sub>w</sub> (H)	CP Pulse Width	7.0		7.0		7.0		ns
t <sub>w</sub> (L)	HIGH or LOW	6.0		6.0		6.0		

## 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:

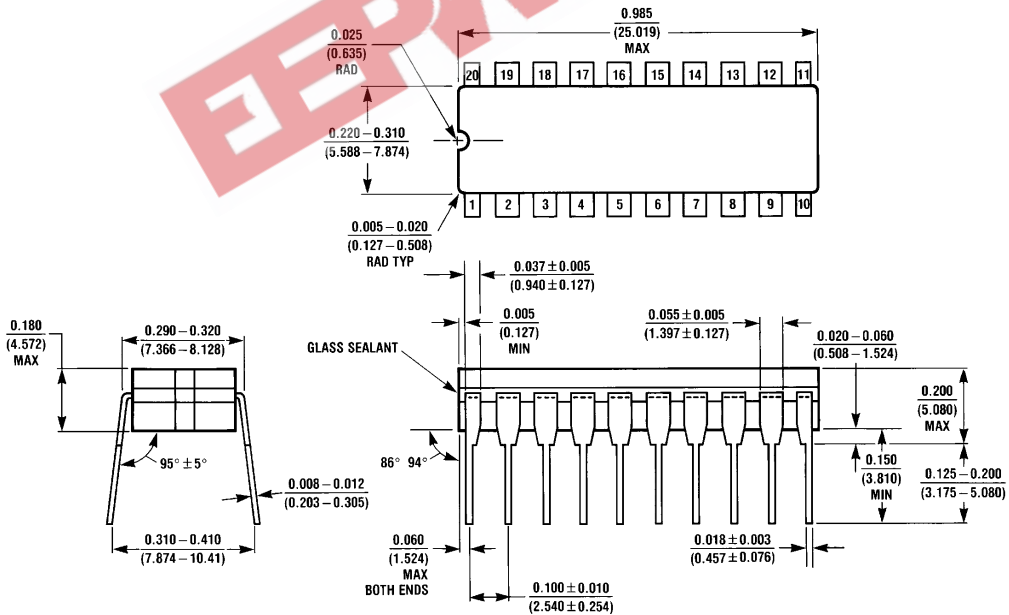


**Physical Dimensions** inches (millimeters)



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

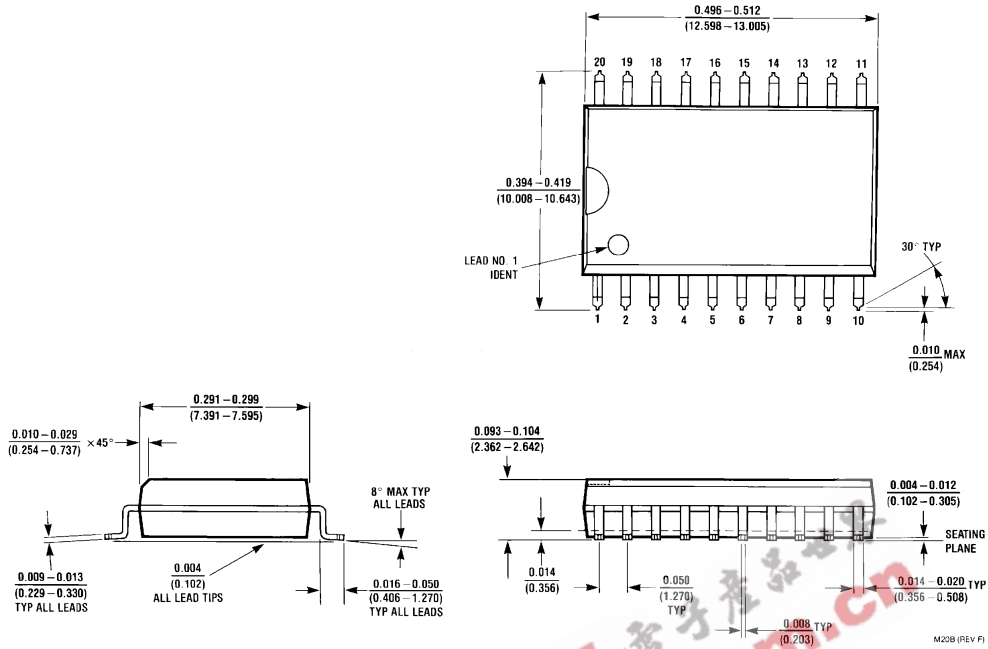
E20A (REV D)



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

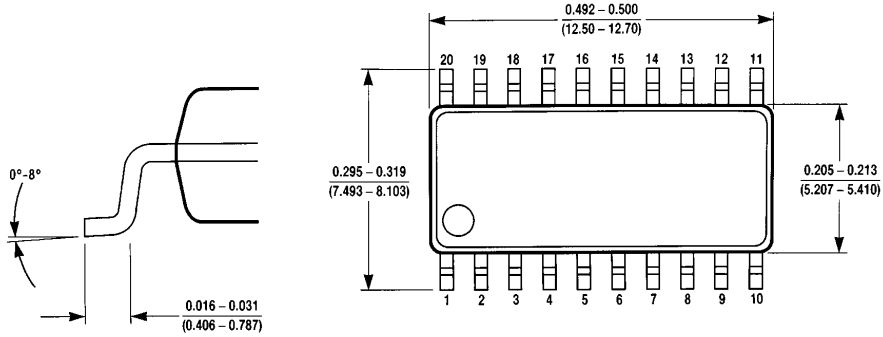
J20A (REV M)

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

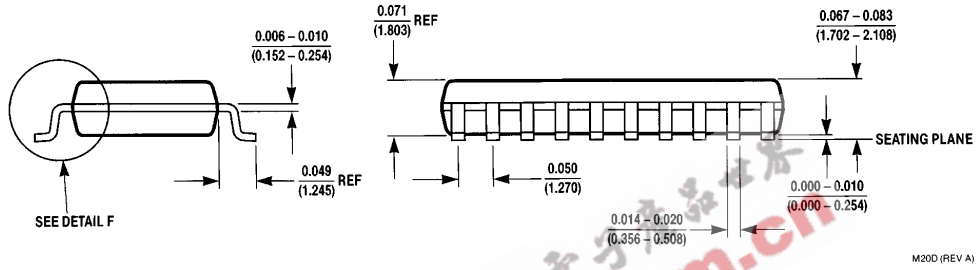


**20-Lead (0.300" Wide) Molded Small Outline Package, JEDEC NS Package Number M20B**

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

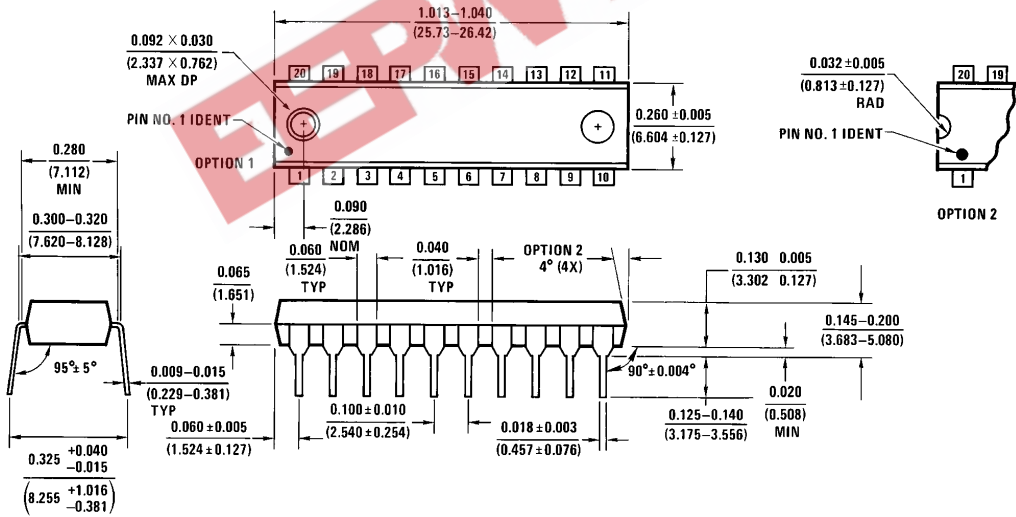


DETAIL F



M20D (REV A)

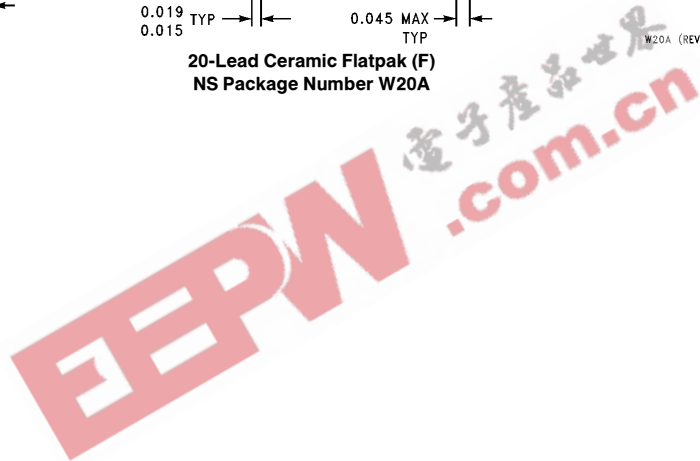
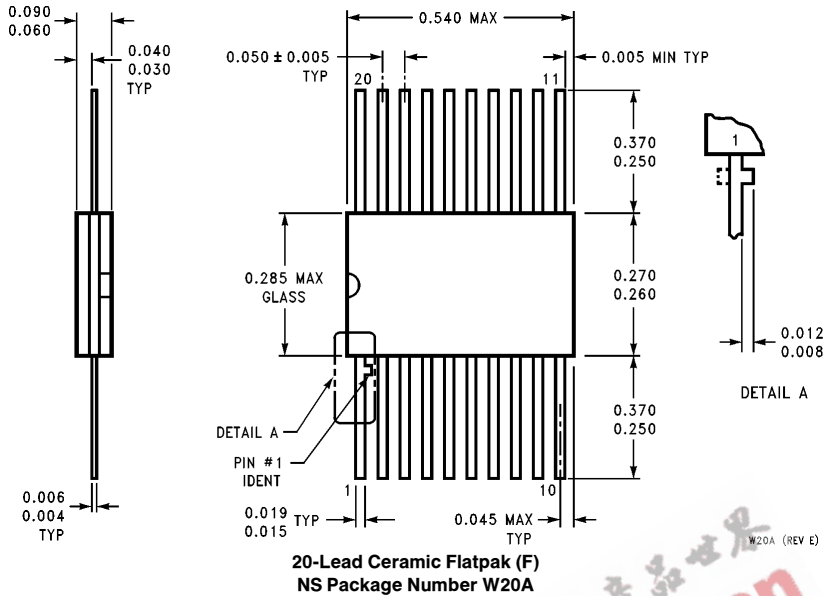
**20-Lead (0.300" Wide) Molded Small Outline Package, EIAJ (SJ)  
NS Package Number M20D**



N20A (REV G)

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

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



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