

## 54F/74F573 Octal D-Type Latch with TRI-STATE® Outputs

### General Description

The 'F573 is a high speed octal latch with buffered common Latch Enable (LE) and buffered common Output Enable ( $\overline{OE}$ ) inputs.

This device is functionally identical to the 'F373 but has different pinouts.

### Features

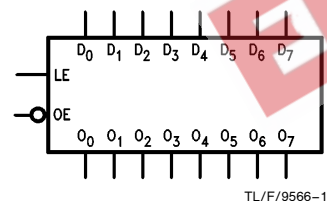
- Inputs and outputs on opposite sides of package allowing easy interface with microprocessors
- Useful as input or output port for microprocessors
- Functionally identical to 'F373
- TRI-STATE outputs for bus interfacing
- Guaranteed 4000V minimum ESD protection

| Commercial        | Military          | Package Number | Package Description                               |
|-------------------|-------------------|----------------|---------------------------------------------------|
| 74F573PC          |                   | N20A           | 20-Lead (0.300" Wide) Molded Dual-In-Line         |
|                   | 54F573DM (Note 2) | J20A           | 20-Lead Ceramic Dual-In-Line                      |
| 74F573SC (Note 1) |                   | M20B           | 20-Lead (0.300" Wide) Molded Small Outline, JEDEC |
| 74F573SJ (Note 1) |                   | M20D           | 20-Lead (0.300" Wide) Molded Small Outline, EIAJ  |
|                   | 54F573FM (Note 2) | W20A           | 20-Lead Cerpak                                    |
|                   | 54F573LM (Note 2) | E20A           | 20-Lead Ceramic Leadless Chip Carrier, Type C     |

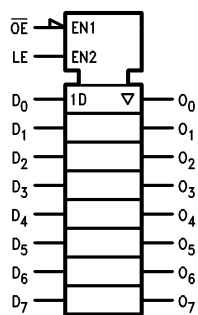
**Note 1:** Devices also available in 13" reel. Use suffix = SCX and SJX.

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

### Logic Symbols

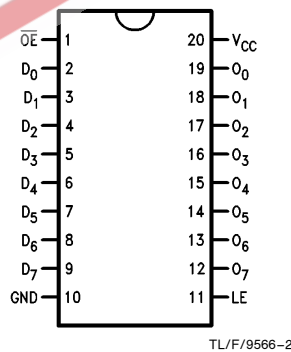


#### IEEE/IEC

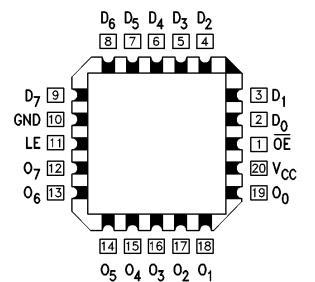


### Connection Diagrams

#### Pin Assignment for DIP, SOIC and Flatpak



#### Pin Assignment for LCC



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## Unit Loading/Fan Out

| Pin Names       | Description                                | 54F/74F          |                                                 |
|-----------------|--------------------------------------------|------------------|-------------------------------------------------|
|                 |                                            | U.L.<br>HIGH/LOW | Input $I_{IH}/I_{IL}$<br>Output $I_{OH}/I_{OL}$ |
| $D_0-D_7$       | Data Inputs                                | 1.0/1.0          | $20\ \mu\text{A}/-0.6\ \text{mA}$               |
| LE              | Latch Enable Input (Active HIGH)           | 1.0/1.0          | $20\ \mu\text{A}/-0.6\ \text{mA}$               |
| $\overline{OE}$ | TRI-STATE Output Enable Input (Active LOW) | 1.0/1.0          | $20\ \mu\text{A}/-0.6\ \text{mA}$               |
| $O_0-O_7$       | TRI-STATE Latch Outputs                    | 150/40(33.3)     | $-3\ \text{mA}/24\ \text{mA}$ (20 mA)           |

## Functional Description

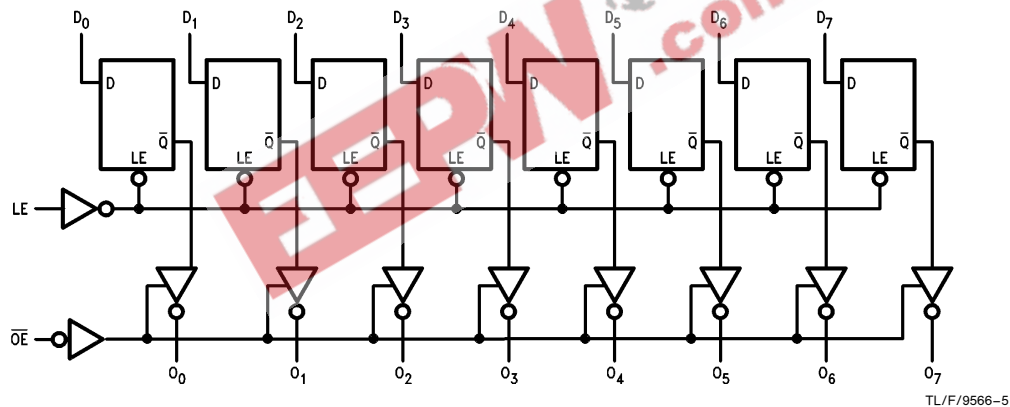
The 'F573 contains eight D-type latches with 3-state output buffers. When the Latch Enable (LE) input is HIGH, data on the  $D_n$  inputs enters the latches. In this condition the latches are transparent, i.e., a latch output will change state each time its D input changes. When LE is LOW the latches store the information that was present on the D inputs a setup time preceding the HIGH-to-LOW transition of LE. The 3-state buffers are controlled by the Output Enable ( $\overline{OE}$ ) input. When  $\overline{OE}$  is LOW, the buffers are in the bi-state mode. When  $\overline{OE}$  is HIGH the buffers are in the high impedance mode but this does not interfere with entering new data into the latches.

Function Table

| Inputs          |    |   | Outputs |
|-----------------|----|---|---------|
| $\overline{OE}$ | LE | D | O       |
| L               | H  | H | H       |
| L               | H  | L | L       |
| L               | L  | X | $O_0$   |
| H               | X  | X | Z       |

H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Immaterial  
 $O_0$  = Value stored from previous clock cycle

## 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.

TL/F/9566-5

## 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><br>54F 10% V <sub>CC</sub><br>74F 10% V <sub>CC</sub><br>74F 10% V <sub>CC</sub><br>74F 5% V <sub>CC</sub><br>74F 5% V <sub>CC</sub> | 2.5<br>2.4<br>2.5<br>2.4<br>2.7<br>2.7 |             | V     | Min             | I <sub>OH</sub> = −1 mA<br>I <sub>OH</sub> = −3 mA<br>I <sub>OH</sub> = −1 mA<br>I <sub>OH</sub> = −3 mA<br>I <sub>OH</sub> = −1 mA<br>I <sub>OH</sub> = −3 mA |
| V <sub>OL</sub>  | Output LOW Voltage                | 54F 10% V <sub>CC</sub><br>74F 10% V <sub>CC</sub>                                                                                                           |                                        | 0.5<br>0.5  | V     | Min             | I <sub>OL</sub> = 20 mA<br>I <sub>OL</sub> = 24 mA                                                                                                             |
| I <sub>IH</sub>  | Input HIGH Current                | 54F<br>74F                                                                                                                                                   |                                        | 20.0<br>5.0 | μA    | Max             | V <sub>IN</sub> = 2.7V                                                                                                                                         |
| I <sub>BVI</sub> | Input HIGH Current Breakdown Test | 54F<br>74F                                                                                                                                                   |                                        | 100<br>7.0  | μA    | Max             | V <sub>IN</sub> = 7.0V                                                                                                                                         |
| I <sub>CEX</sub> | Output HIGH Leakage Current       | 54F<br>74F                                                                                                                                                   |                                        | 250<br>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<br>All Other Pins Grounded                                                                                                            |
| I <sub>OD</sub>  | Output Leakage Circuit Current    | 74F                                                                                                                                                          |                                        | 3.75        | μA    | 0.0             | V <sub>IOD</sub> = 150 mV<br>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                                    | −150        | 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>CC1</sub> | Power Supply Current              |                                                                                                                                                              | 35                                     | 55          | mA    | Max             | V <sub>O</sub> = LOW                                                                                                                                           |
| I <sub>CC2</sub> | Power Supply Current              |                                                                                                                                                              | 35                                     | 55          | mA    | Max             | V <sub>O</sub> = HIGH Z                                                                                                                                        |

## AC Electrical Characteristics

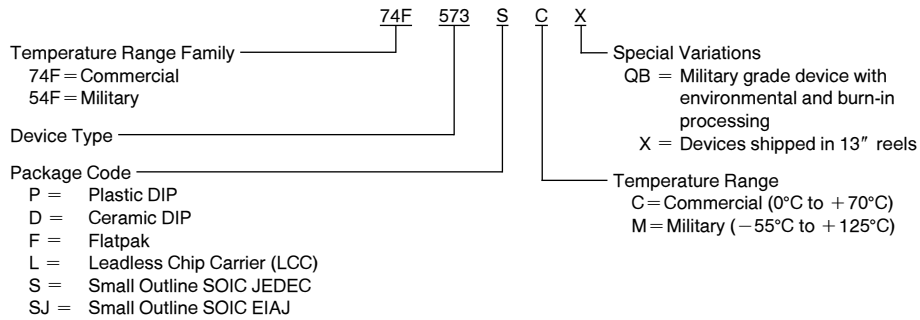
| Symbol                 | Parameter                           | 74F                                                                            |            |             | 54F                                                |              | 74F                                                |             | Units |
|------------------------|-------------------------------------|--------------------------------------------------------------------------------|------------|-------------|----------------------------------------------------|--------------|----------------------------------------------------|-------------|-------|
|                        |                                     | $T_A = +25^{\circ}\text{C}$<br>$V_{CC} = +5.0\text{V}$<br>$C_L = 50\text{ pF}$ |            |             | $T_A, V_{CC} = \text{Mil}$<br>$C_L = 50\text{ pF}$ |              | $T_A, V_{CC} = \text{Com}$<br>$C_L = 50\text{ pF}$ |             |       |
|                        |                                     | Min                                                                            | Typ        | Max         | Min                                                | Max          | Min                                                | Max         |       |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>$D_n$ to $O_n$ | 3.0<br>2.0                                                                     | 5.3<br>3.7 | 7.0<br>6.0  | 3.0<br>2.0                                         | 9.0<br>7.0   | 3.0<br>2.0                                         | 8.0<br>6.5  | ns    |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>LE to $O_n$    | 5.0<br>3.0                                                                     | 9.0<br>5.2 | 11.0<br>7.0 | 5.0<br>3.0                                         | 13.5<br>7.5  | 5.0<br>3.0                                         | 12.0<br>7.0 | ns    |
| $t_{PZH}$<br>$t_{PZL}$ | Output Enable Time                  | 2.0<br>2.0                                                                     | 5.0<br>5.6 | 8.0<br>8.5  | 2.0<br>2.0                                         | 10.0<br>10.0 | 2.0<br>2.0                                         | 9.0<br>9.5  | ns    |
| $t_{PHZ}$<br>$t_{PLZ}$ | Output Disable Time                 | 1.5<br>1.5                                                                     | 4.5<br>3.8 | 5.5<br>5.5  | 1.5<br>1.5                                         | 7.0<br>5.5   | 1.5<br>1.5                                         | 6.5<br>5.5  |       |

## AC Operating Requirements

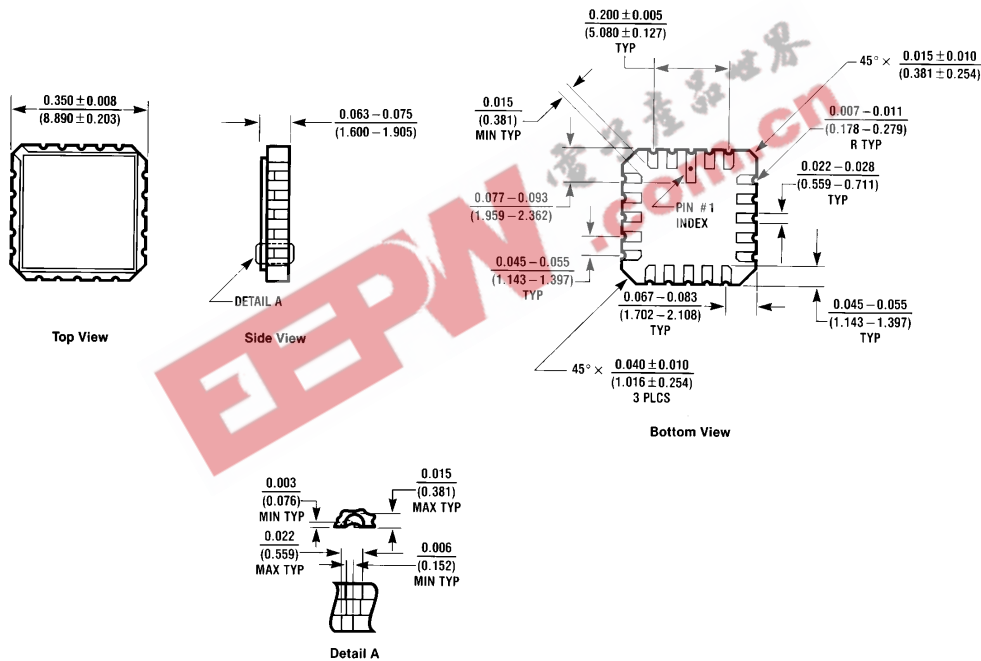
| Symbol                             | Parameter                              | 74F                                                    |     | 54F                        |     | 74F                        |     | Units |
|------------------------------------|----------------------------------------|--------------------------------------------------------|-----|----------------------------|-----|----------------------------|-----|-------|
|                                    |                                        | $T_A = +25^{\circ}\text{C}$<br>$V_{CC} = +5.0\text{V}$ |     | $T_A, V_{CC} = \text{Mil}$ |     | $T_A, V_{CC} = \text{Com}$ |     |       |
|                                    |                                        | Min                                                    | Max | Min                        | Max | Min                        | Max |       |
| $t_s(\text{H})$<br>$t_s(\text{L})$ | Setup Time, HIGH or LOW<br>$D_n$ to LE | 2.0<br>2.0                                             |     | 2.0<br>2.0                 |     | 2.0<br>2.0                 |     | ns    |
| $t_h(\text{H})$<br>$t_h(\text{L})$ | Hold Time, HIGH or LOW<br>$D_n$ to LE  | 3.0<br>3.5                                             |     | 3.0<br>4.0                 |     | 3.0<br>3.5                 |     |       |
| $t_w(\text{H})$                    | LE Pulse Width, HIGH                   | 4.0                                                    |     | 4.0                        |     | 4.0                        |     | ns    |

## 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:



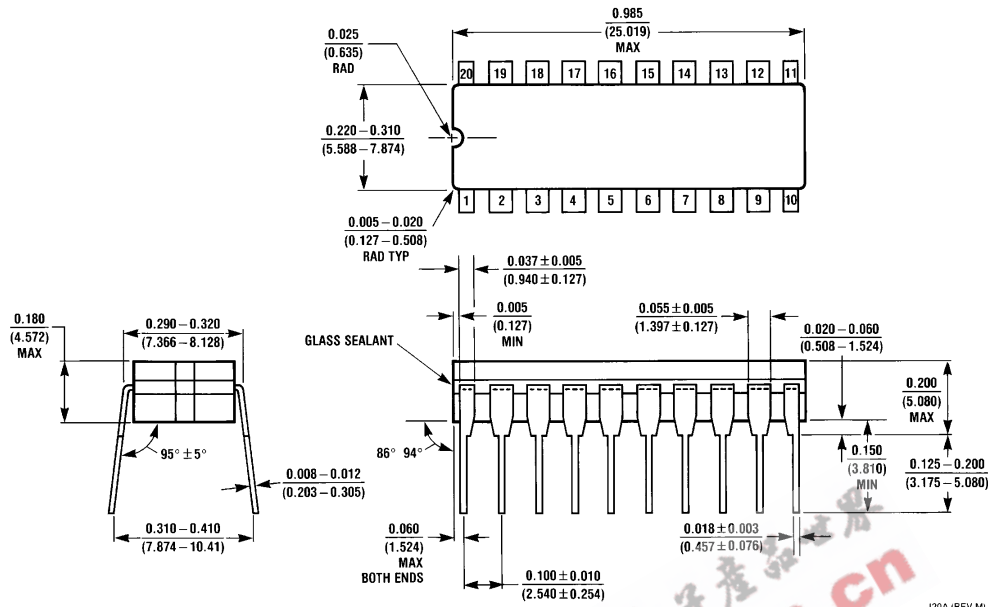
## Physical Dimensions inches (millimeters)



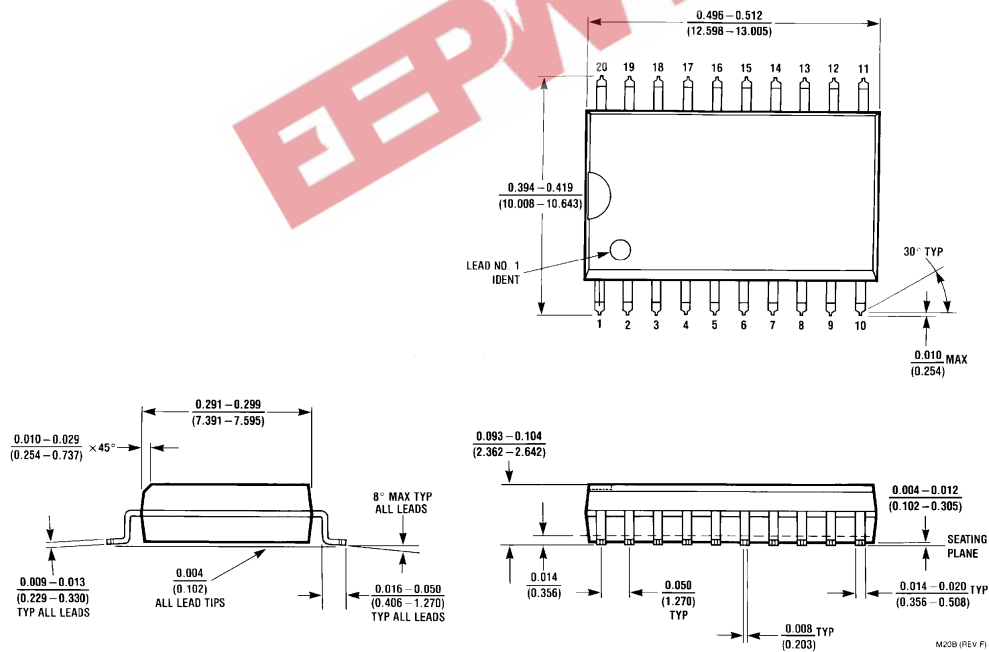
**20-Lead Ceramic Leadless Chip Carrier (L)  
NS Package Number E20A**

E20A (REV D)

# Physical Dimensions inches (millimeters) (Continued)

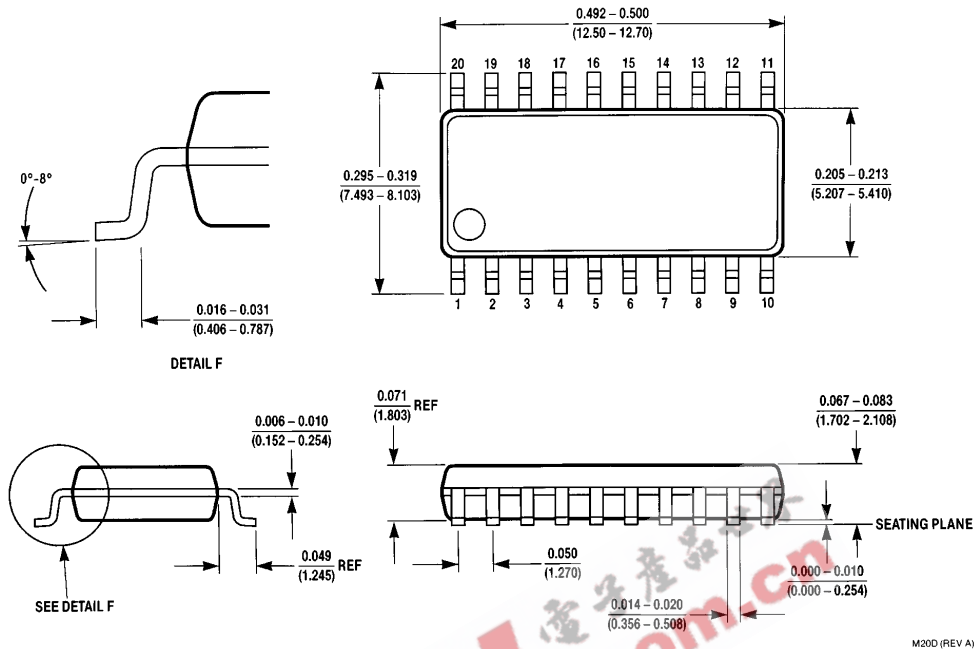


20-Lead Ceramic Dual-In-Line Package (D)  
NS Package Number J20A

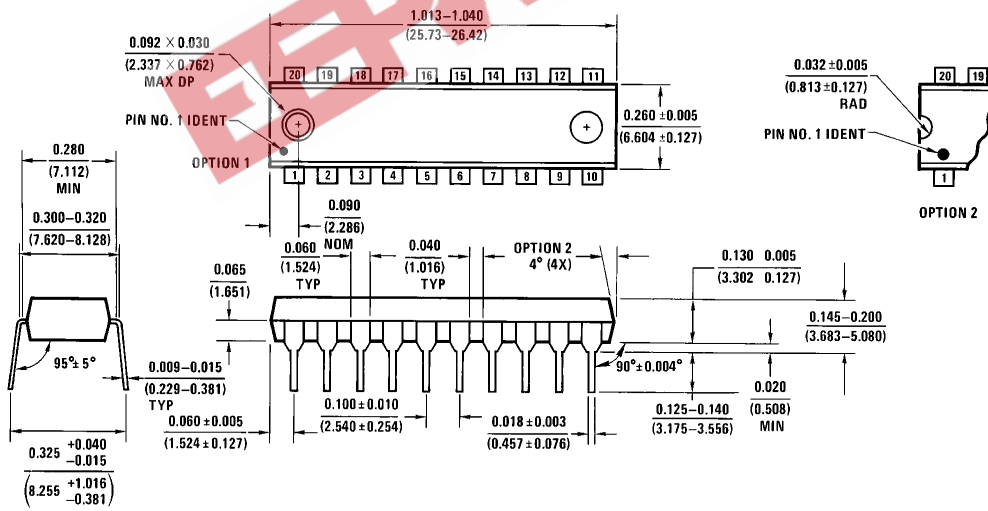


20-Lead (0.300" Wide) Molded Small Outline Package, JEDEC (S)  
NS Package Number M20B

### Physical Dimensions inches (millimeters) (Continued)



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



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



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