

## 54F/74F533 Octal Transparent Latch with TRI-STATE® Outputs

### General Description

The 'F533 consists of eight latches with TRI-STATE outputs for bus organized system applications. The flip-flops appear transparent to the data when Latch Enable (LE) is HIGH. When LE is LOW, the data that meets the setup times is latched. Data appears on the bus when the Output Enable ( $\overline{OE}$ ) is LOW. When  $\overline{OE}$  is HIGH the bus output is in the high impedance state. The 'F533 is the same as the 'F373, except that the outputs are inverted.

### Features

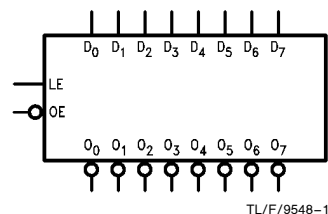
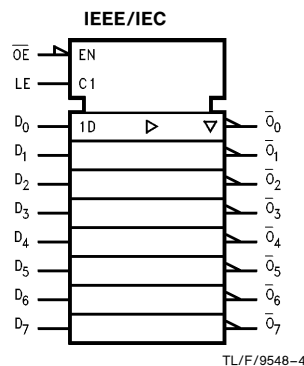
- Eight latches in a single package
- TRI-STATE outputs for bus interfacing
- Inverted version of the 'F373
- Guaranteed 4000V minimum ESD protection

| Commercial        | Military          | Package Number | Package Description                               |
|-------------------|-------------------|----------------|---------------------------------------------------|
| 74F533PC          |                   | N20A           | 20-Lead (0.300" Wide) Molded Dual-In-Line         |
|                   | 54F533DM (Note 2) | J20A           | 20-Lead Ceramic Dual-In-Line                      |
| 74F533SC (Note 1) |                   | M20B           | 20-Lead (0.300" Wide) Molded Small Outline, JEDEC |
| 74F533SJ (Note 1) |                   | M20D           | 20-Lead (0.300" Wide) Molded Small Outline, EIAJ  |
|                   | 54F533FM (Note 2) | W20A           | 20-Lead Cerpack                                   |
|                   | 54F533LM (Note 2) | E20A           | 20-Lead Ceramic Leadless Chip Carrier, Type C     |

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

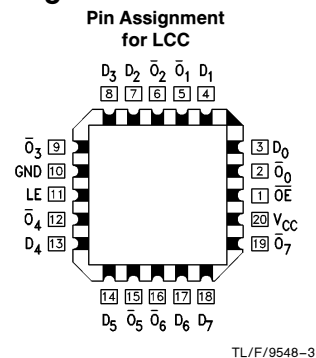
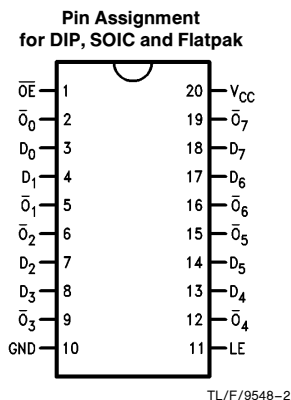
**Note 2:** Military grade device with environmental and burn-in processing. Use suffix = DMQB, FMQB and LMQB.

### Logic Symbols



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### Connection Diagrams



| Pin Names                                         | Description                      | 54F/74F          |                                                                                   |
|---------------------------------------------------|----------------------------------|------------------|-----------------------------------------------------------------------------------|
|                                                   |                                  | U.L.<br>HIGH/LOW | Input I <sub>IH</sub> /I <sub>IL</sub><br>Output I <sub>OH</sub> /I <sub>OL</sub> |
| D <sub>0</sub> –D <sub>7</sub>                    | Data Inputs                      | 1.0/1.0          | 20 μA/ –0.6 mA                                                                    |
| LE                                                | Latch Enable Input (Active HIGH) | 1.0/1.0          | 20 μA/ –0.6 mA                                                                    |
| $\overline{\text{OE}}$                            | Output Enable Input (Active LOW) | 1.0/1.0          | 20 μA/ –0.6 mA                                                                    |
| $\overline{\text{O}}_0$ – $\overline{\text{O}}_7$ | Complementary TRI-STATE Outputs  | 150/40 (33.3)    | –3 mA/24 mA (20 mA)                                                               |

| Inputs |                 |   | Output           |
|--------|-----------------|---|------------------|
| LE     | $\overline{OE}$ | D | $\overline{O}$   |
| H      | L               | H | L                |
| H      | L               | L | H                |
| L      | L               | X | $\overline{O}_0$ |
| X      | H               | X | Z                |

TL/F/9548-5

## 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>BVIT</sub> | Input HIGH Current Breakdown (I/O) | 54F<br>74F                                                                                                                                                   |                                        |     | 1.0<br>0.5  | mA    | Max             | V <sub>IN</sub> = 5.5V                                                                                                                                         |
| 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>CCZ</sub>  | Power Supply Current               |                                                                                                                                                              |                                        | 41  | 61          | mA    | Max             | V <sub>O</sub> = HIGH Z                                                                                                                                        |

## AC Electrical Characteristics

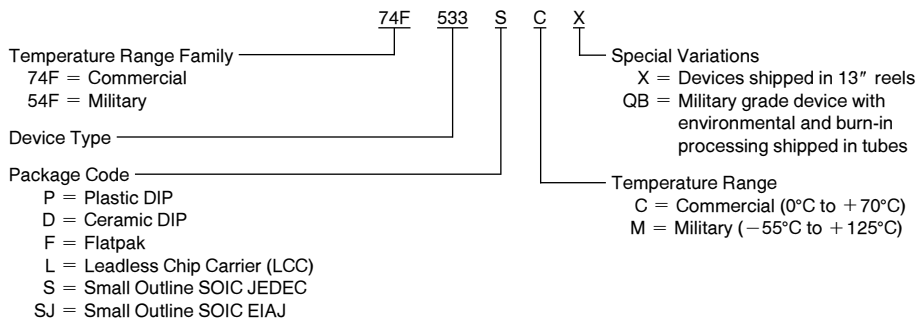
| Symbol                 | Parameter                                      | 74F                                                                            |            |             | 54F                                                |              | 74F                                                |             | 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 $\overline{O}_n$ | 4.0<br>2.5                                                                     | 6.7<br>4.4 | 9.0<br>7.0  | 4.0<br>2.5                                         | 12.0<br>9.0  | 4.0<br>2.5                                         | 10.0<br>8.0 | ns    |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>LE to $\overline{O}_n$    | 5.0<br>3.0                                                                     | 7.1<br>4.7 | 11.0<br>7.0 | 5.0<br>3.0                                         | 14.0<br>9.0  | 5.0<br>3.0                                         | 13.0<br>8.0 | ns    |
| $t_{PZH}$<br>$t_{PZL}$ | Output Enable Time                             | 2.0<br>2.0                                                                     | 5.9<br>5.6 | 10.0<br>7.5 | 2.0<br>2.0                                         | 12.5<br>10.5 | 2.0<br>2.0                                         | 11.0<br>8.5 | ns    |
| $t_{PHZ}$<br>$t_{PLZ}$ | Output Disable Time                            | 1.5<br>1.5                                                                     | 3.4<br>2.7 | 6.5<br>5.5  | 1.5<br>1.5                                         | 8.5<br>7.5   | 1.5<br>1.5                                         | 7.0<br>6.5  | ns    |

## AC Operating Requirements

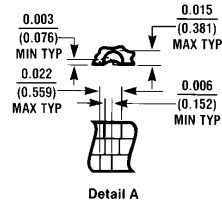
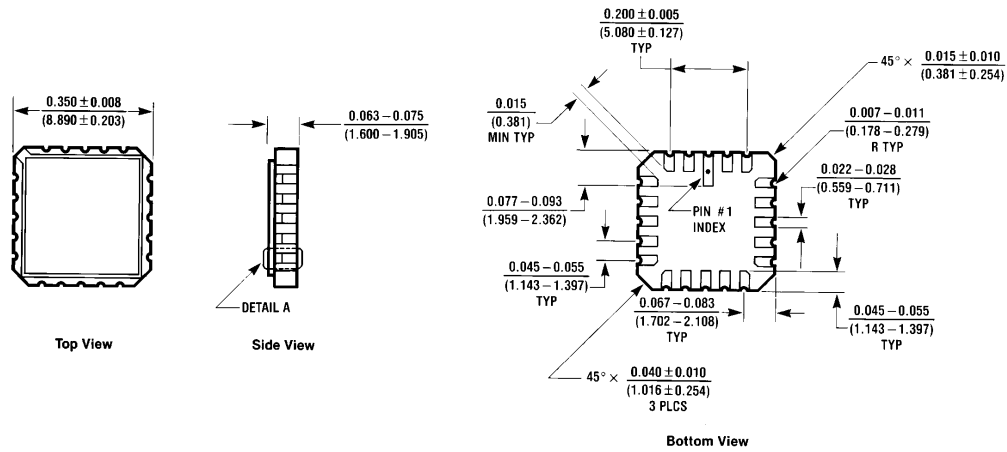
| Symbol                             | Parameter                              | 74F                                                    |     | 54F                        |     | 74F                        |     | Units |
|------------------------------------|----------------------------------------|--------------------------------------------------------|-----|----------------------------|-----|----------------------------|-----|-------|
|                                    |                                        | $T_A = +25^{\circ}\text{C}$<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>3.0                                             |     | 3.0<br>3.0                 |     | 3.0<br>3.0                 |     | ns    |
| $t_w(\text{H})$                    | LE Pulse Width, HIGH                   | 6.0                                                    |     | 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:

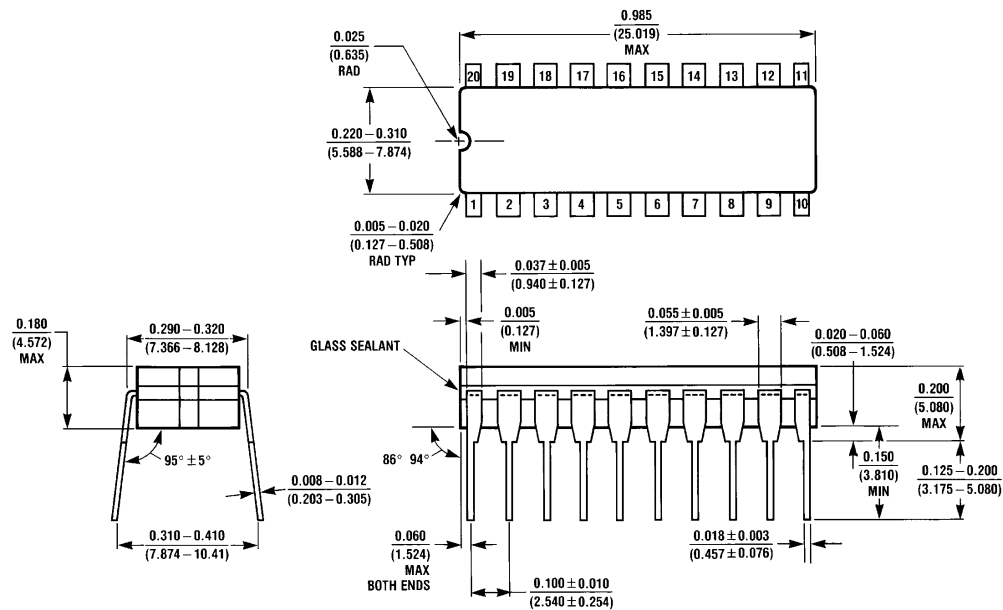


## Physical Dimensions inches (millimeters)



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

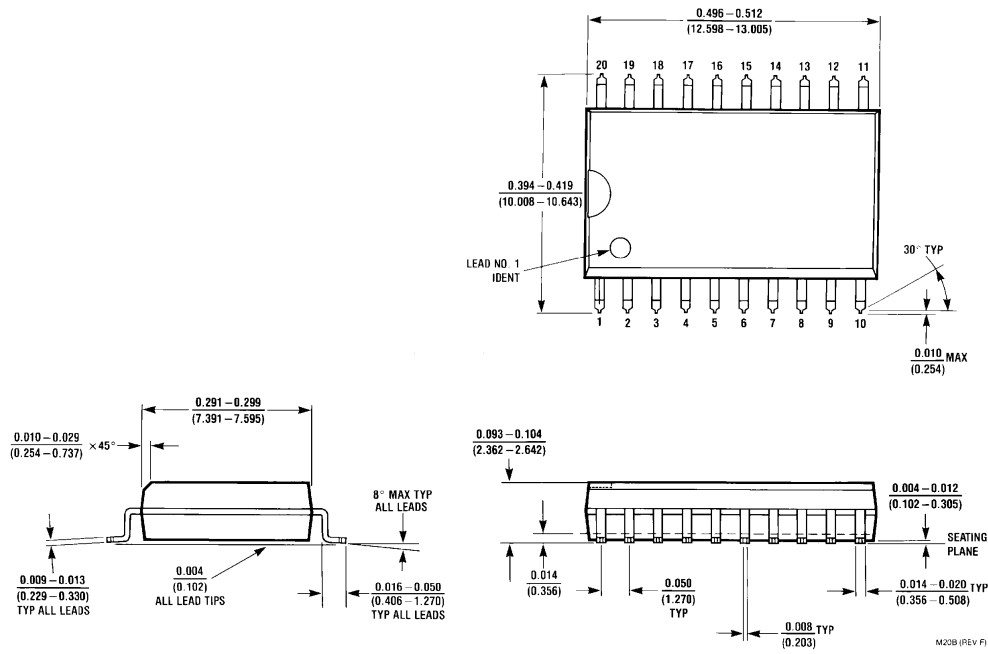
E20A (REV D)



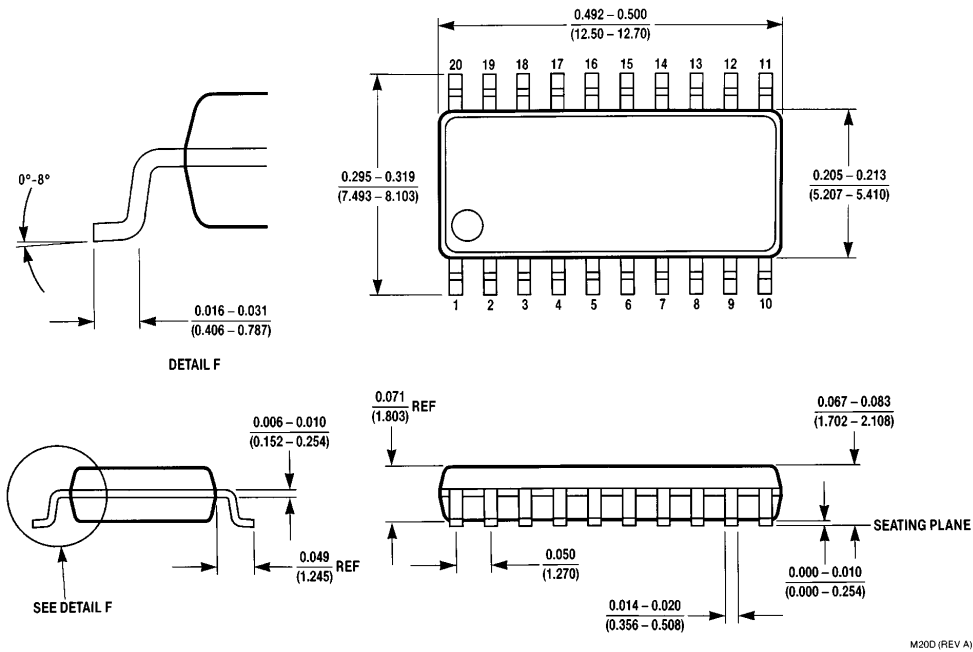
**20-Lead Ceramic Dual-In-Line Package (D)**  
**NS Package Number J20A**

J20A (REV M)

# Physical Dimensions inches (millimeters) (Continued)

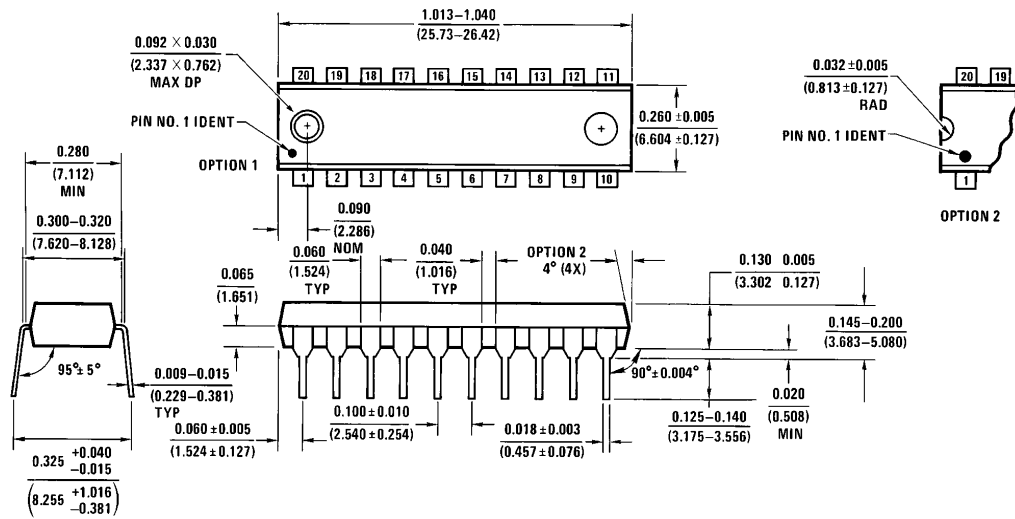


**20-Lead (0.300" Wide) Molded Small Outline Package, JEDEC (S)  
NS Package Number M20B**



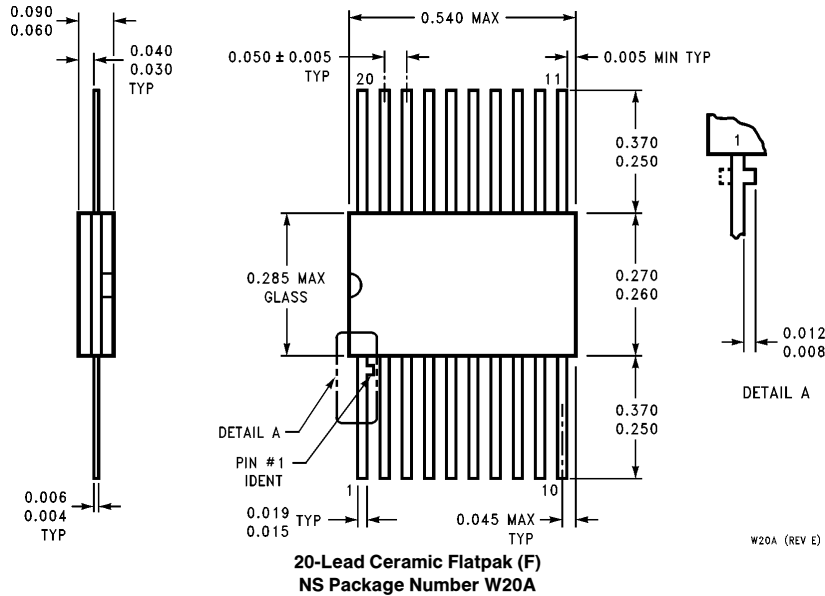
**20-Lead (0.300" Wide) Molded Small Outline Package, EIAJ (SJ)  
NS Package Number M20D**

# Physical Dimensions inches (millimeters) (Continued)



N20A (REV G)

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

**Physical Dimensions** inches (millimeters) (Continued)**LIFE SUPPORT POLICY**

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