

May 1995

## 54F/74F240•54F/74F241•54F/74F244 Octal Buffers/Line Drivers with TRI-STATE® Outputs

### General Description

The 'F240, 'F241 and 'F244 are octal buffers and line drivers designed to be employed as memory and address drivers, clock drivers and bus-oriented transmitters/receivers which provide improved PC and board density.

### Features

- TRI-STATE outputs drive bus lines or buffer memory address registers
- Outputs sink 64 mA (48 mA mil)
- 12 mA source current
- Input clamp diodes limit high-speed termination effects
- Guaranteed 4000V minimum ESD protection

| Commercial         | Military          | Package Number | Package Description                               |
|--------------------|-------------------|----------------|---------------------------------------------------|
| 74F240PC           |                   | N20A           | 20-Lead (0.300" Wide) Molded Dual-In-Line         |
|                    | 54F240DM (Note 2) | J20A           | 20-Lead Ceramic Dual-In-Line                      |
| 74F240SC (Note 1)  |                   | M20B           | 20-Lead (0.300" Wide) Molded Small Outline, JEDEC |
| 74F240SJ (Note 1)  |                   | M20D           | 20-Lead (0.300" Wide) Molded Small Outline, EIAJ  |
|                    | 54F240FM (Note 2) | W20A           | 20-Lead Cerpack                                   |
|                    | 54F240LM (Note 2) | E20A           | 20-Lead Ceramic Leadless Chip Carrier, Type C     |
| 74F241PC           |                   | N20A           | 20-Lead (0.300" Wide) Molded Dual-In-Line         |
|                    | 54F241DM (Note 2) | J20A           | 20-Lead Ceramic Dual-In-Line                      |
| 74F241SC (Note 1)  |                   | M20B           | 20-Lead (0.300" Wide) Molded Small Outline, JEDEC |
| 74F241SJ (Note 1)  |                   | M20D           | 20-Lead (0.300" Wide) Molded Small Outline, EIAJ  |
|                    | 54F241FM (Note 2) | W20A           | 20-Lead Cerpack                                   |
|                    | 54F241LM (Note 2) | E20A           | 20-Lead Ceramic Leadless Chip Carrier, Type C     |
| 74F244PC           |                   | N20A           | 20-Lead (0.300" Wide) Molded Dual-In-Line         |
|                    | 54F244DM (Note 2) | J20A           | 20-Lead Ceramic Dual-In-Line                      |
| 74F244SC (Note 1)  |                   | M20B           | 20-Lead (0.300" Wide) Molded Small Outline, JEDEC |
| 74F244SJ (Note 1)  |                   | M20D           | 20-Lead (0.300" Wide) Molded Small Outline, EIAJ  |
| 74F244MSA (Note 1) |                   | MSA20          | 20-Lead Molded Shrink Small Outline, EIAJ Type II |
|                    | 54F244FM (Note 2) | W20A           | 20-Lead Cerpack                                   |
|                    | 54F244LM (Note 2) | E20A           | 20-Lead Ceramic Leadless Chip Carrier, Type C     |

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

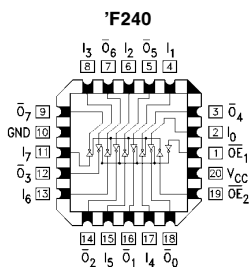
**Note 2:** Military grade device with environmental and burn-in processing. Use suffix = DMOB, FMOB and LMOB.

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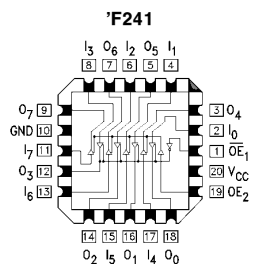
54F/74F240•54F/74F241•54F/74F244  
Octal Buffers/Line Drivers with TRI-STATE Outputs

## Connection Diagrams

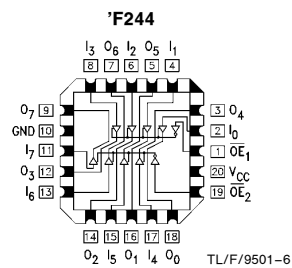
### Pin Assignment for LCC



TL/F/9501-2

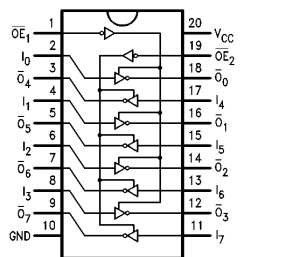


TL/F/9501-4

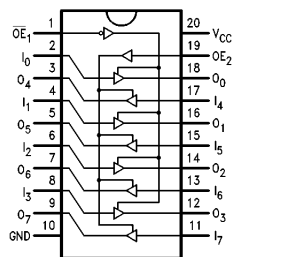


TL/F/9501-6

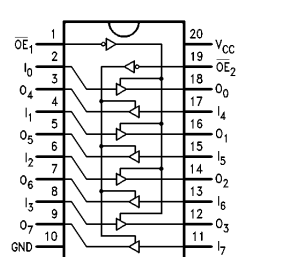
### Pin Assignment for DIP, SOIC, SSOP and Flatpak



TL/F/9501-1

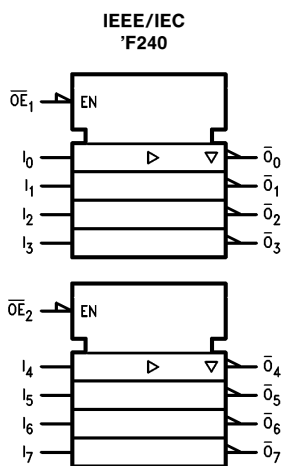


TL/F/9501-3

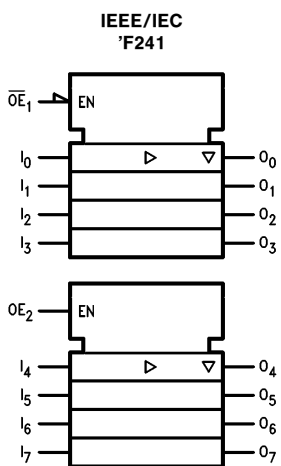


TL/F/9501-5

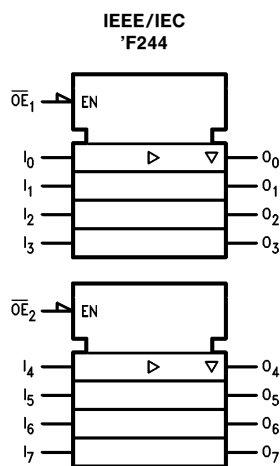
## Logic Symbols



TL/F/9501-7



TL/F/9501-8



TL/F/9501-9

## Unit Loading/Fan Out

| Pin Names                                | Description                                 | 54F/74F          |                                                 |
|------------------------------------------|---------------------------------------------|------------------|-------------------------------------------------|
|                                          |                                             | U.L.<br>HIGH/LOW | Input $I_{IH}/I_{IL}$<br>Output $I_{OH}/I_{OL}$ |
| $\overline{OE}_1, \overline{OE}_2$       | TRI-STATE Output Enable Input (Active LOW)  | 1.0/1.667        | 20 $\mu A$ / – 1 mA                             |
| $OE_2$                                   | TRI-STATE Output Enable Input (Active HIGH) | 1.0/1.667        | 20 $\mu A$ / – 1 mA                             |
| $I_0-I_7$                                | Inputs ('F240)                              | 1.0/1.667*       | 20 $\mu A$ / – 1 mA                             |
| $I_0-I_7$                                | Inputs ('F241, 'F244)                       | 1.0/2.667*       | 20 $\mu A$ / – 1.6 mA                           |
| $\overline{O}_0-\overline{O}_7, O_0-O_7$ | Outputs                                     | 600/106.6 (80)   | – 12 mA/64 mA (48 mA)                           |

\*Worst-case 'F240 enabled; 'F241, 'F244 disabled

## Truth Tables

'F240

| $\overline{OE}_1$ | $D_{1n}$ | $O_{1n}$ | $\overline{OE}_2$ | $D_{2n}$ | $O_{2n}$ |
|-------------------|----------|----------|-------------------|----------|----------|
| H                 | X        | Z        | H                 | X        | Z        |
| L                 | H        | L        | L                 | H        | L        |
| L                 | L        | H        | L                 | L        | H        |

'F241

| $\overline{OE}_1$ | $D_{1n}$ | $O_{1n}$ | $OE_2$ | $D_{2n}$ | $O_{2n}$ |
|-------------------|----------|----------|--------|----------|----------|
| H                 | X        | Z        | L      | X        | Z        |
| L                 | H        | H        | H      | H        | H        |
| L                 | L        | L        | H      | L        | L        |

'F244

| $\overline{OE}_1$ | $D_{1n}$ | $O_{1n}$ | $\overline{OE}_2$ | $D_{2n}$ | $O_{2n}$ |
|-------------------|----------|----------|-------------------|----------|----------|
| H                 | X        | Z        | H                 | X        | Z        |
| L                 | H        | H        | L                 | H        | H        |
| L                 | L        | L        | L                 | L        | L        |

H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Immaterial  
Z = High Impedance

## 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> | 2.4<br>2.0<br>2.4<br>2.0<br>2.7 |              | V     | Min             | I <sub>OH</sub> = −3 mA<br>I <sub>OH</sub> = −12 mA<br>I <sub>OH</sub> = −3 mA<br>I <sub>OH</sub> = −15 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>                                                                                 |                                 | 0.55<br>0.55 | V     | Min             | I <sub>OL</sub> = 48 mA<br>I <sub>OL</sub> = 64 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                 |                                                                                                                                    |                                 | −1.0<br>−1.6 | mA    | Max             | V <sub>IN</sub> = 0.5V ( $\overline{OE}_1$ , $\overline{OE}_2$ , OE <sub>2</sub> , D <sub>n</sub> ('F240'))<br>V <sub>IN</sub> = 0.5V (D <sub>n</sub> ('F241', 'F244')) |
| 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      |                                                                                                                                    | −100                            | −225         | mA    | Max             | V <sub>OUT</sub> = 0V                                                                                                                                                   |
| I <sub>ZZ</sub>  | Bus Drainage Test                 |                                                                                                                                    |                                 | 500          | μA    | 0.0V            | V <sub>OUT</sub> = 5.25V                                                                                                                                                |

## DC Electrical Characteristics (Continued)

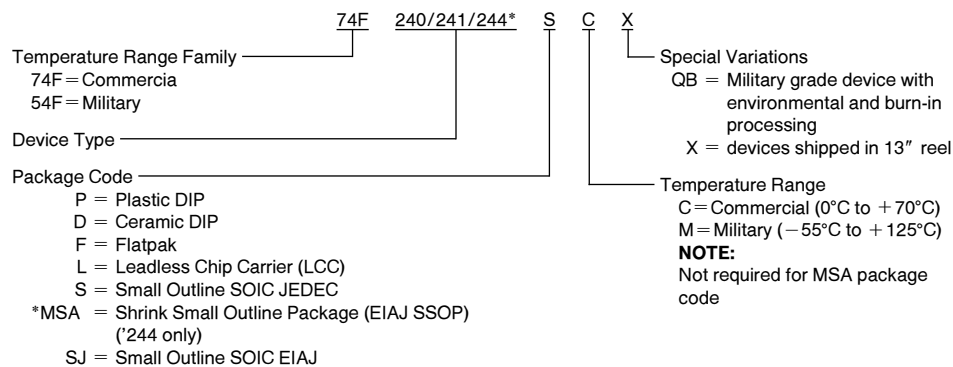
| Symbol            | Parameter                           | 54F/74F |     |     | Units | V <sub>CC</sub> | Conditions              |
|-------------------|-------------------------------------|---------|-----|-----|-------|-----------------|-------------------------|
|                   |                                     | Min     | Typ | Max |       |                 |                         |
| I <sub>CC</sub> H | Power Supply Current ('F240)        | 19      | 29  |     | mA    | Max             | V <sub>O</sub> = HIGH   |
| I <sub>CC</sub> L | Power Supply Current ('F240)        | 50      | 75  |     | mA    | Max             | V <sub>O</sub> = LOW    |
| I <sub>CC</sub> Z | Power Supply Current ('F240)        | 42      | 63  |     | mA    | Max             | V <sub>O</sub> = HIGH Z |
| I <sub>CC</sub> H | Power Supply Current ('F241, 'F244) | 40      | 60  |     | mA    | Max             | V <sub>O</sub> = HIGH   |
| I <sub>CC</sub> L | Power Supply Current ('F241, 'F244) | 60      | 90  |     | mA    | Max             | V <sub>O</sub> = LOW    |
| I <sub>CC</sub> Z | Power Supply Current ('F241, 'F244) | 60      | 90  |     | mA    | Max             | V <sub>O</sub> = HIGH Z |

## AC Electrical Characteristics

| Symbol           | Parameter                          | 74F                                                                         |     |     | 54F                                                              |      | 74F                                                              |      | Units |
|------------------|------------------------------------|-----------------------------------------------------------------------------|-----|-----|------------------------------------------------------------------|------|------------------------------------------------------------------|------|-------|
|                  |                                    | T <sub>A</sub> = +25°C<br>V <sub>CC</sub> = +5.0V<br>C <sub>L</sub> = 50 pF |     |     | T <sub>A</sub> , V <sub>CC</sub> = Mil<br>C <sub>L</sub> = 50 pF |      | T <sub>A</sub> , V <sub>CC</sub> = Com<br>C <sub>L</sub> = 50 pF |      |       |
|                  |                                    | Min                                                                         | Typ | Max | Min                                                              | Max  | Min                                                              | Max  |       |
| t <sub>PLH</sub> | Propagation Delay                  | 3.0                                                                         | 5.1 | 7.0 | 3.0                                                              | 9.0  | 3.0                                                              | 8.0  | ns    |
| t <sub>PHL</sub> | Data to Output ('F240)             | 2.0                                                                         | 3.5 | 4.7 | 2.0                                                              | 6.0  | 2.0                                                              | 5.7  |       |
| t <sub>PZH</sub> | Output Enable Time ('F240)         | 2.0                                                                         | 3.5 | 4.7 | 2.0                                                              | 6.5  | 2.0                                                              | 5.7  | ns    |
| t <sub>PZL</sub> |                                    | 4.0                                                                         | 6.9 | 9.0 | 4.0                                                              | 10.5 | 4.0                                                              | 10.0 |       |
| t <sub>PHZ</sub> | Output Disable Time ('F240)        | 2.0                                                                         | 4.0 | 5.3 | 2.0                                                              | 6.5  | 2.0                                                              | 6.3  | ns    |
| t <sub>PLZ</sub> |                                    | 2.0                                                                         | 6.0 | 8.0 | 2.0                                                              | 12.5 | 2.0                                                              | 9.5  |       |
| t <sub>PLH</sub> | Propagation Delay                  | 2.5                                                                         | 4.0 | 5.2 | 2.0                                                              | 6.5  | 2.5                                                              | 6.2  | ns    |
| t <sub>PHL</sub> | Data to Output ('F241, 'F244)      | 2.5                                                                         | 4.0 | 5.2 | 2.0                                                              | 7.0  | 2.5                                                              | 6.5  |       |
| t <sub>PZH</sub> | Output Enable Time ('F241, 'F244)  | 2.0                                                                         | 4.3 | 5.7 | 2.0                                                              | 7.0  | 2.0                                                              | 6.7  | ns    |
| t <sub>PZL</sub> |                                    | 2.0                                                                         | 5.4 | 7.0 | 2.0                                                              | 8.5  | 2.0                                                              | 8.0  |       |
| t <sub>PHZ</sub> | Output Disable Time ('F241, 'F244) | 2.0                                                                         | 4.5 | 6.0 | 2.0                                                              | 7.0  | 2.0                                                              | 7.0  | ns    |
| t <sub>PLZ</sub> |                                    | 2.0                                                                         | 4.5 | 6.0 | 2.0                                                              | 7.5  | 2.0                                                              | 7.0  |       |

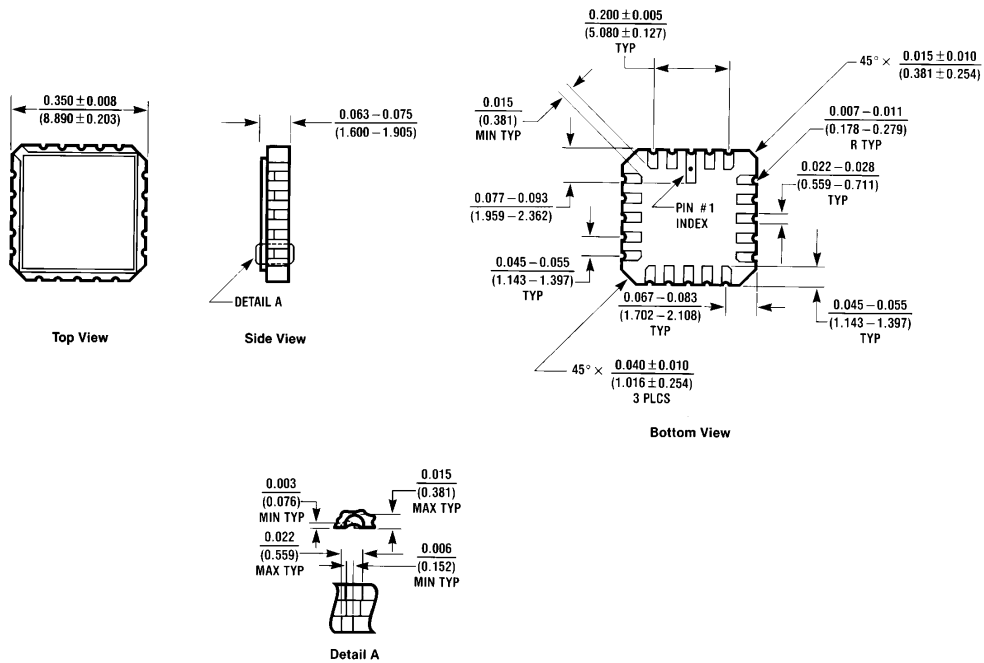
## Ordering Information

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



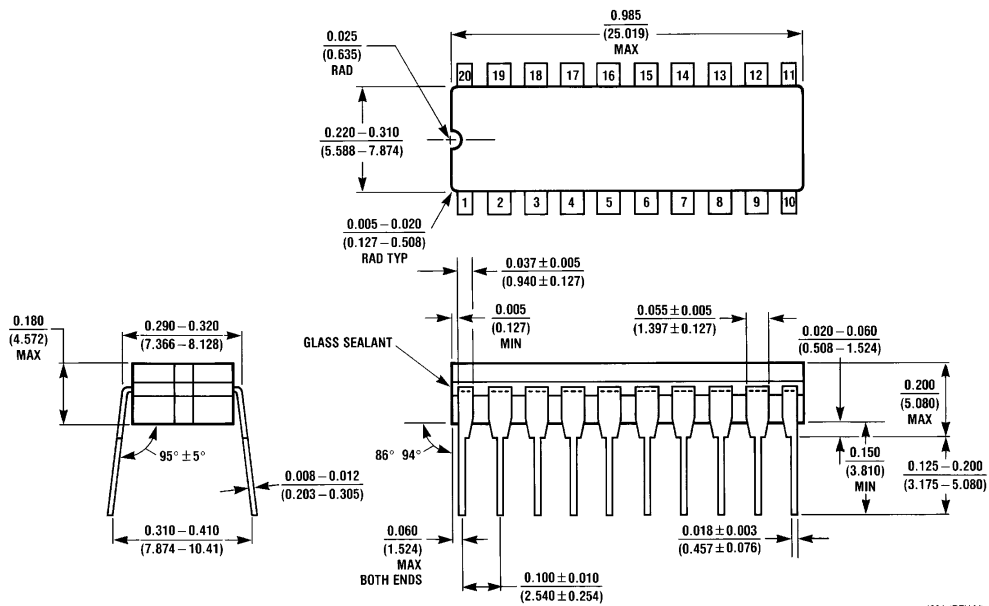


# Physical Dimensions inches (millimeters)



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

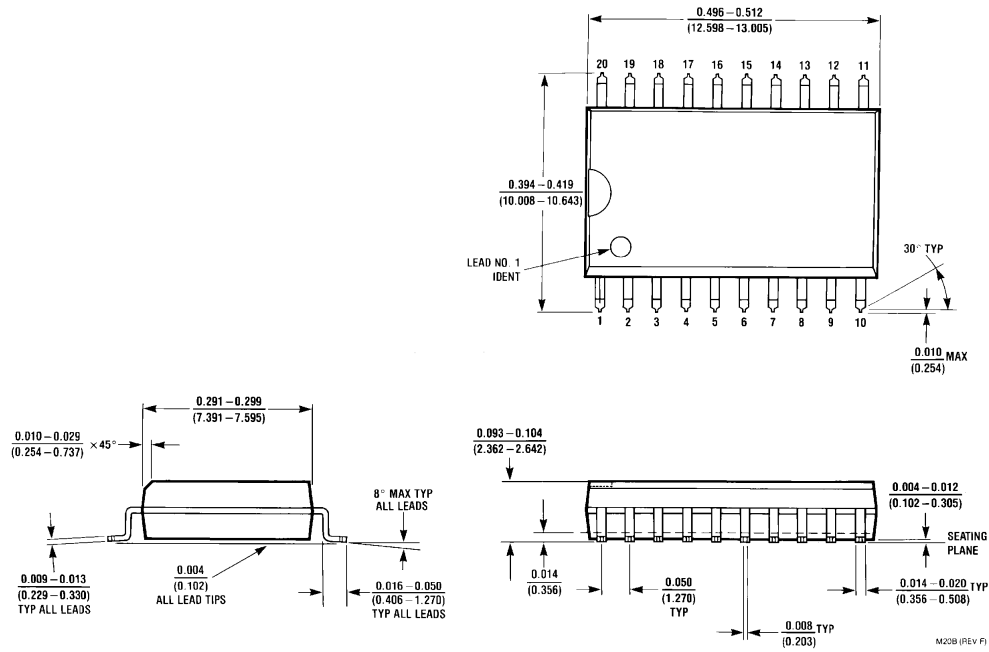
E20A (REV D)



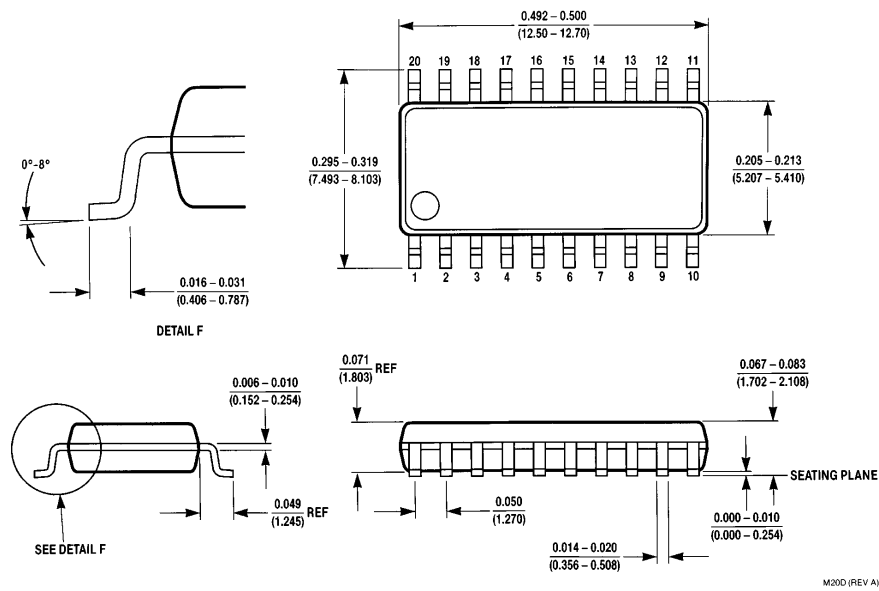
20-Lead Ceramic Dual-In-Line Package (D)  
NS Package Number J20A

J20A (REV M)

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

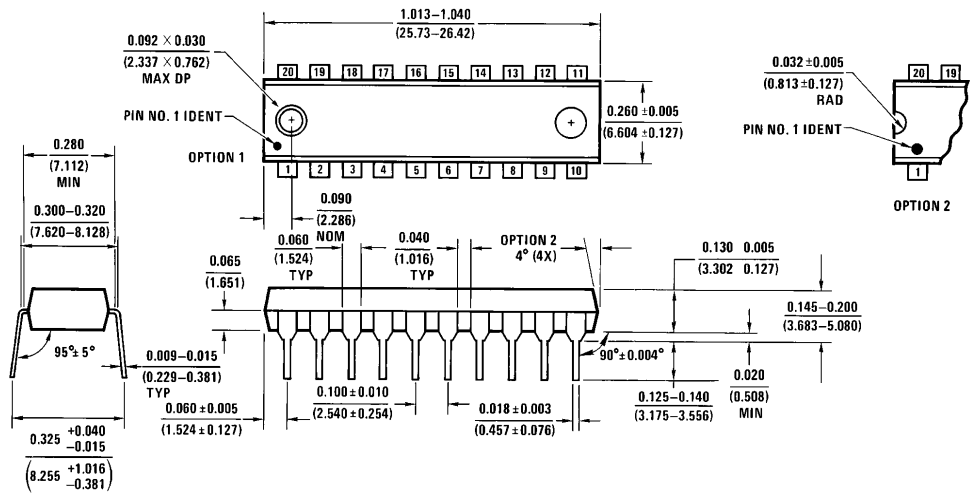
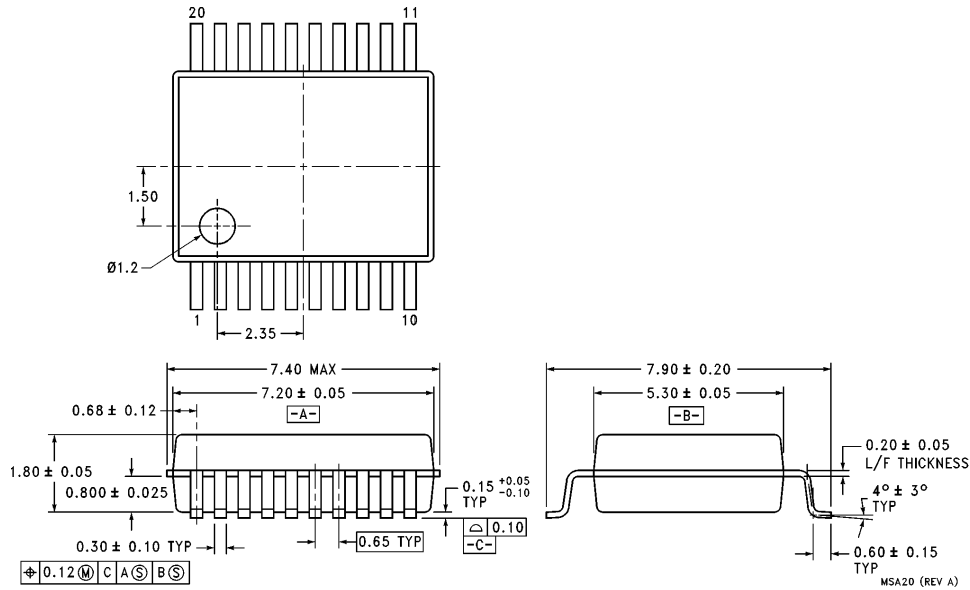


**20-Lead (0.300" Wide) Molded Small Outline Package, JEDEC (S)**  
**NS Package Number M20B**

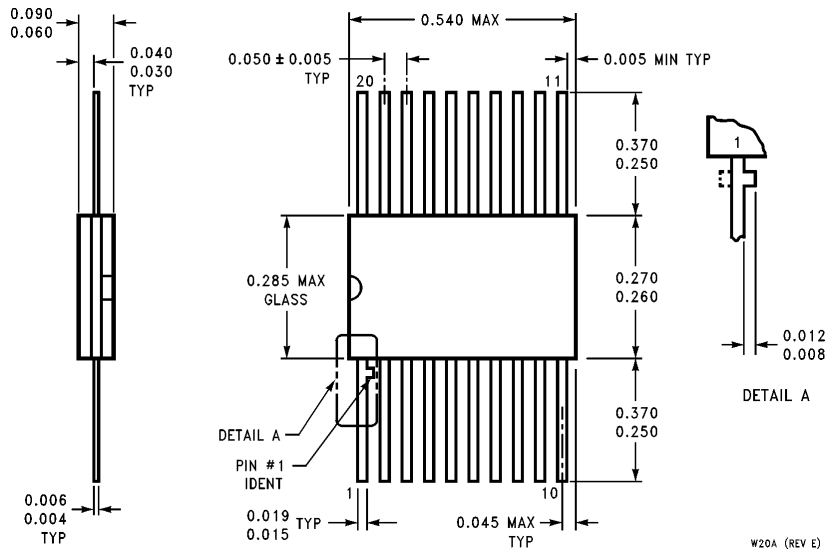


**20-Lead (0.300" Wide) Molded Small Outline Package, EIAJ (SJ)**  
**NS Package Number M20D**

# Physical Dimensions inches (millimeters) (Continued)



## Physical Dimensions inches (millimeters) (Continued)



**20-Lead Ceramic Flatpak (F)  
NS Package Number W20A**

### LIFE SUPPORT POLICY

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**National Semiconductor Corporation**  
2900 Semiconductor Drive  
P.O. Box 58090  
Santa Clara, CA 95052-8090  
Tel: (408) 272-9959  
TWX: (910) 339-9240

**National Semiconductor GmbH**  
Livny-Gargan-Str. 10  
D-82256 Fürstentfeldbruck  
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,  
Chiba 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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