

## 54F/74F545 Octal Bidirectional Transceiver with TRI-STATE® Outputs

### General Description

The 54F545 is an 8-bit, TRI-STATE, high-speed transceiver. It provides bidirectional drive for bus-oriented microprocessor and digital communications systems. Straight through bidirectional transceivers are featured, with 24 mA (20 mA Mil) bus drive capability on the A ports and 64 mA (48 mA Mil) bus drive capability on the B ports.

One input, Transmit/Receive (T/R) determines the direction of logic signals through the bidirectional transceiver. Transmit enables data from A ports to B ports; Receive enables data from B ports to A ports. The Output Enable input disables both A and B ports by placing them in a TRI-STATE condition.

### Features

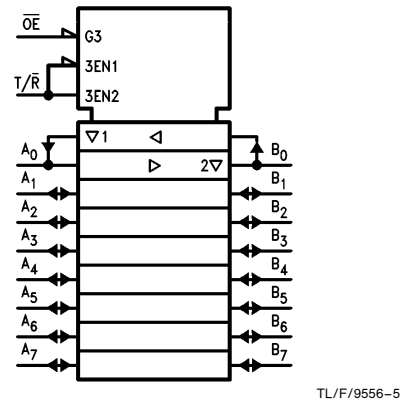
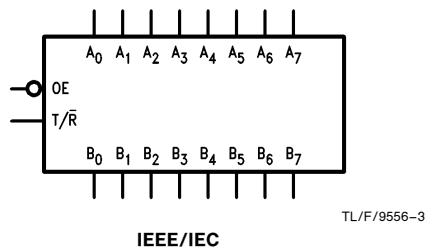
- Higher drive than 8304
- 8-bit bidirectional data flow reduces system package count
- TRI-STATE inputs/outputs for interfacing with bus-oriented systems
- 24 mA (20 mA Mil) and 64 mA (48 mA Mil) bus drive capability on A and B ports, respectively
- Transmit/Receive and Output Enable simplify control logic
- Guaranteed 4000V minimum ESD protection
- Pin for Pin compatible with Intel 8286

| Commercial        | Military          | Package Number | Package Description                               |
|-------------------|-------------------|----------------|---|
| 74F545PC          |                   | N20A           | 20-Lead (0.300" Wide) Molded Dual-In-Line         |
|                   | 54F545DM (Note 2) | J20A           | 20-Lead Ceramic Dual-In-Line                      |
| 74F545SC (Note 1) |                   | M20B           | 20-Lead (0.300" Wide) Molded Small Outline, JEDEC |
| 74F545SJ (Note 1) |                   | M20D           | 20-Lead (0.300" Wide) Molded Small Outline, EIAJ  |
|                   | 54F545FM (Note 2) | W20A           | 20-Lead Cerpack                                   |
|                   | 54F545LM (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.

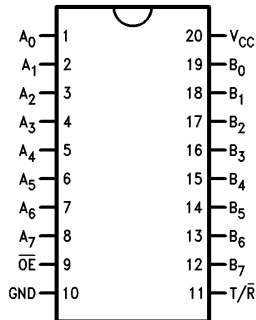
### Logic Symbols



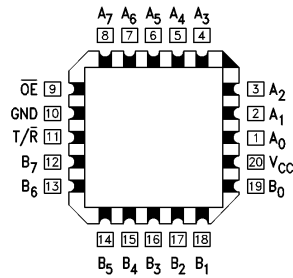
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## Connection Diagrams

Pin Assignment for  
DIP, SOIC and Flatpak



Pin Assignment  
for LCC



TL/F/9556-2

TL/F/9556-1

Truth Table

| Inputs          |                  | Outputs             |
|-----------------|------------------|---------------------|
| $\overline{OE}$ | $T/\overline{R}$ |                     |
| L               | L                | Bus B Data to Bus A |
| L               | H                | Bus A Data to Bus B |
| H               | X                | High Z              |

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

## Unit Loading/Fan Out

| Pin Names        | Description                                     | 54F/74F          |   |
|------------------|---|------------------|---|
|                  |   | U.L.<br>HIGH/LOW | Input $I_{IH}/I_{IL}$<br>Output $I_{OH}/I_{OL}$   |
| $\overline{OE}$  | Output Enable Input (Active LOW)                | 1.0/2.0          | 20 $\mu A$ / -1.2 mA                              |
| $T/\overline{R}$ | Transmit/Receive Input                          | 1.0/2.0          | 20 $\mu A$ / -1.2 mA                              |
| $A_0$ - $A_7$    | Side A TRI-STATE Inputs or<br>TRI-STATE Outputs | 3.5/1.083        | 70 $\mu A$ / -650 $\mu A$<br>-3 mA/24 mA (20 mA)  |
| $B_0$ - $B_7$    | Side B TRI-STATE Inputs or<br>TRI-STATE Outputs | 3.5/1.083        | 70 $\mu A$ / -650 $\mu A$<br>-12 mA/64 mA (48 mA) |

## 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          |  | -1.2   |                            |              | V     | Min             | I <sub>IN</sub> = -18 mA ( $\overline{OE}$ , T/ $\overline{R}$ )   |
| V <sub>OH</sub>                    | Output HIGH Voltage                | 54F 10% V <sub>CC</sub><br>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 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>2.0<br>2.5<br>2.4<br>2.0<br>2.7<br>2.7 |                            |              | V     | Min             | I <sub>OH</sub> = -1 mA (A <sub>n</sub> )<br>I <sub>OH</sub> = -3 mA (A <sub>n</sub> )<br>I <sub>OH</sub> = -12 mA (B <sub>n</sub> )<br>I <sub>OH</sub> = -1 mA (A <sub>n</sub> )<br>I <sub>OH</sub> = -3 mA (A <sub>n</sub> )<br>I <sub>OH</sub> = -15 mA (B <sub>n</sub> )<br>I <sub>OH</sub> = -1 mA (A <sub>n</sub> )<br>I <sub>OH</sub> = -3 mA (A <sub>n</sub> ) |
| V <sub>OL</sub>                    | Output LOW 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>   |  | 0.5<br>0.55<br>0.5<br>0.55 |              | V     | Min             | I <sub>OL</sub> = 20 mA (A <sub>n</sub> )<br>I <sub>OL</sub> = 48 mA (B <sub>n</sub> )<br>I <sub>OL</sub> = 24 mA (A <sub>n</sub> )<br>I <sub>OL</sub> = 64 mA (B <sub>n</sub> )   |
| I <sub>IH</sub>                    | Input HIGH Current                 | 54F<br>74F   |  | 20.0<br>5.0                |              | μA    | Max             | V <sub>IN</sub> = 2.7V ( $\overline{OE}$ , T/ $\overline{R}$ )   |
| I <sub>BVI</sub>                   | Input HIGH Current Breakdown Test  | 54F<br>74F   |  | 100<br>7.0                 |              | μA    | Max             | V <sub>IN</sub> = 7.0V ( $\overline{OE}$ , T/ $\overline{R}$ )   |
| 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 (A <sub>n</sub> , B <sub>n</sub> )  |
| 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>ID</sub> = 150 mV<br>All Other Pins Grounded  |
| I <sub>IL</sub>                    | Input LOW Current                  |  |  | -1.2                       |              | mA    | Max             | V <sub>IN</sub> = 0.5V ( $\overline{OE}$ , T/ $\overline{R}$ )   |
| I <sub>IH</sub> + I <sub>OZH</sub> | Output Leakage Current             |  |  | 70                         |              | μA    | Max             | V <sub>OUT</sub> = 2.7V (A <sub>n</sub> , B <sub>n</sub> )   |
| I <sub>IL</sub> + I <sub>OZL</sub> | Output Leakage Current             |  |  | -650                       |              | μA    | Max             | V <sub>OUT</sub> = 0.5V (A <sub>n</sub> , B <sub>n</sub> )   |
| I <sub>OS</sub>                    | Output Short-Circuit Current       |  |  | -60<br>-100                | -150<br>-225 | mA    | Max             | V <sub>OUT</sub> = 0V (A <sub>n</sub> )<br>V <sub>OUT</sub> = 0V (B <sub>n</sub> )   |

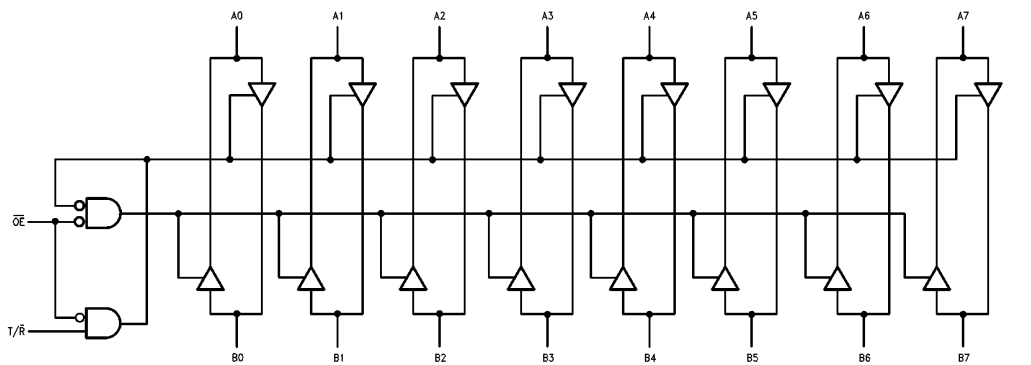
## DC Electrical Characteristics (Continued)

| Symbol           | Parameter            | 54F/74F |     |     | Units | V <sub>CC</sub> | Conditions               |
|------------------|----------------------|---------|-----|-----|-------|-----------------|--------------------------|
|                  |                      | Min     | Typ | Max |       |                 |                          |
| I <sub>ZZ</sub>  | Bus Drainage Test    |         |     | 500 | μA    | 0.0V            | V <sub>OUT</sub> = 5.25V |
| I <sub>CCH</sub> | Power Supply Current |         | 70  | 90  | mA    | Max             | V <sub>O</sub> = HIGH    |
| I <sub>CCL</sub> | Power Supply Current |         | 95  | 120 | mA    | Max             | V <sub>O</sub> = LOW     |
| I <sub>CCZ</sub> | Power Supply Current |         | 85  | 110 | 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  | 2.5   | 4.2 | 6.0 | 2.0  | 7.5  | 2.5  | 7.0 | ns    |
| t <sub>PHL</sub> | A <sub>n</sub> to B <sub>n</sub> or B <sub>n</sub> to A <sub>n</sub> | 2.5   | 4.6 | 6.0 | 2.0  | 7.5  | 2.5  | 7.0 |       |
| t <sub>PZH</sub> | Output Enable Time   | 3.0   | 5.3 | 7.0 | 2.5  | 9.0  | 3.0  | 8.0 | ns    |
| t <sub>PZL</sub> |  | 3.5   | 6.0 | 8.0 | 3.0  | 10.0 | 3.5  | 9.0 |       |
| t <sub>PHZ</sub> | Output Disable Time  | 3.0   | 5.0 | 6.5 | 2.5  | 9.0  | 3.0  | 7.5 | ns    |
| t <sub>PLZ</sub> |  | 2.0   | 5.0 | 6.5 | 2.0  | 10.0 | 2.0  | 7.5 |       |

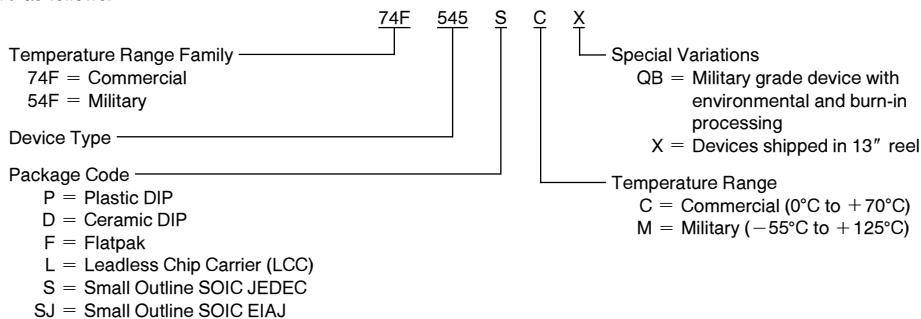
## Logic Diagram



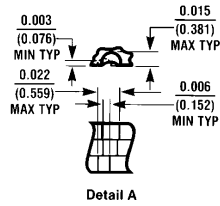
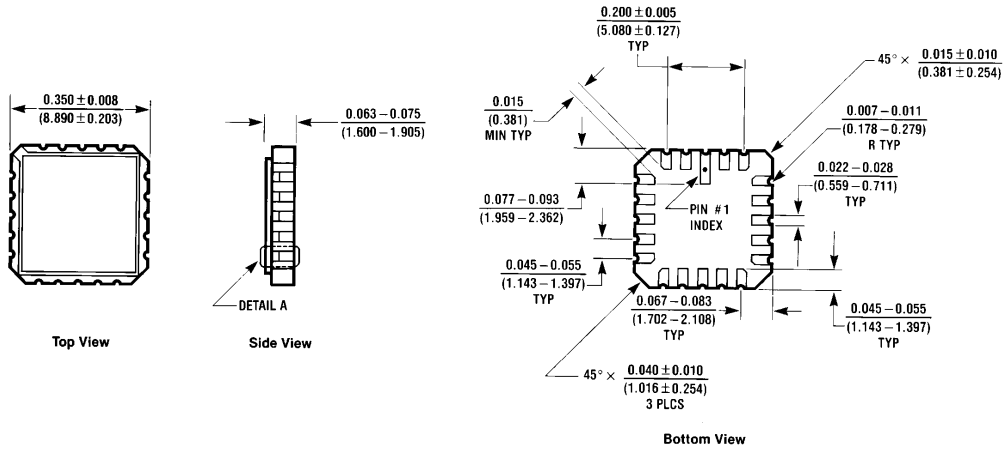
Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

## 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:

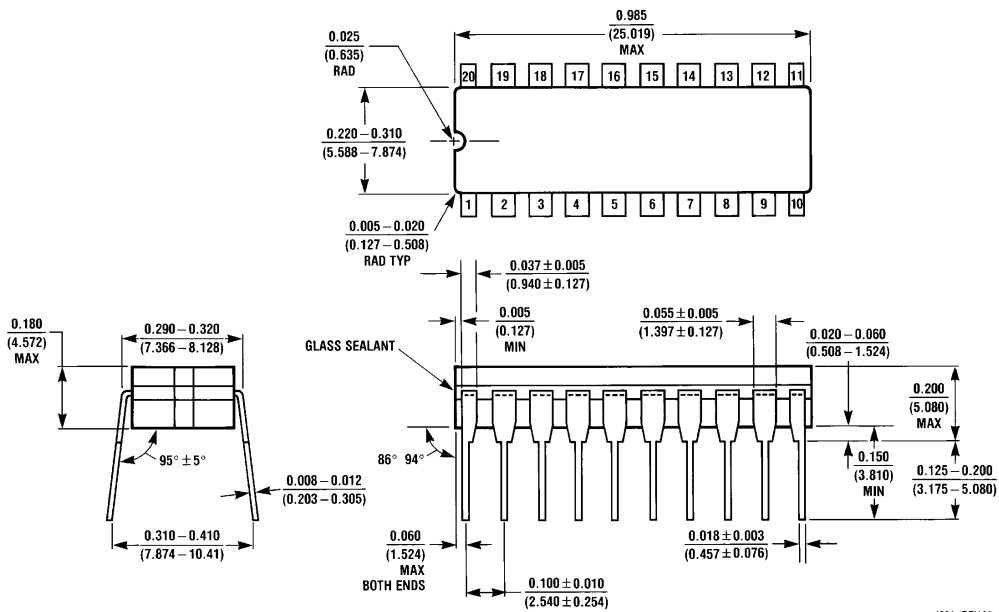


**Physical Dimensions** inches (millimeters)



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

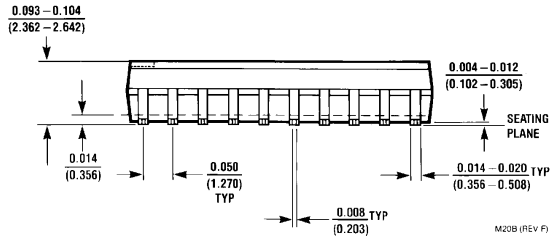
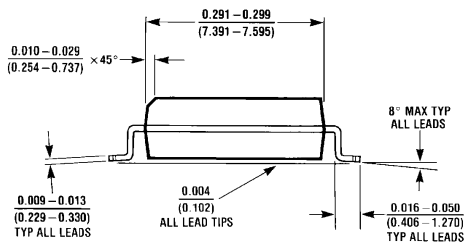
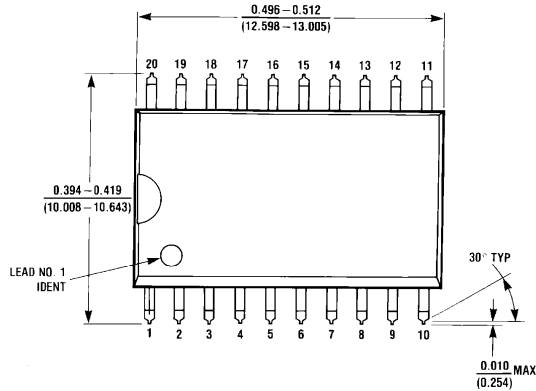
E20A (REV D)



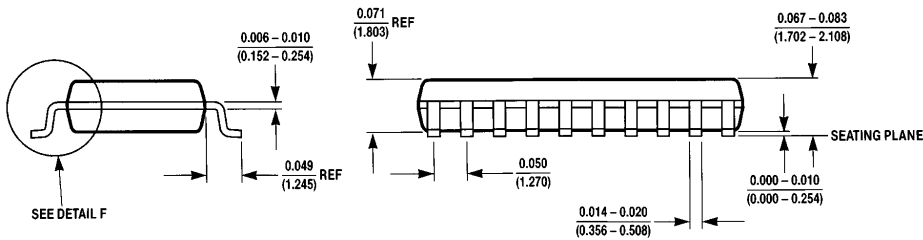
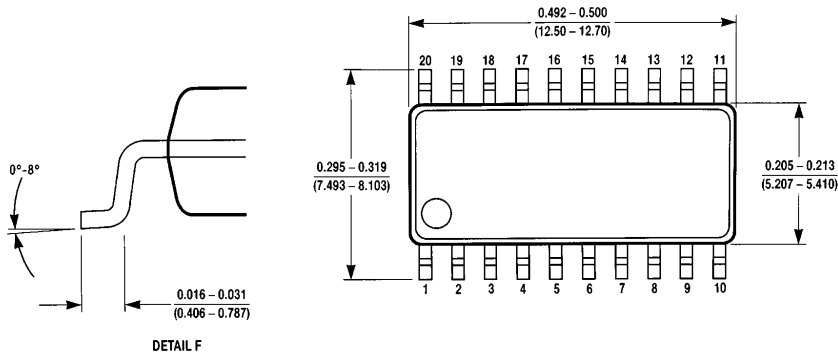
**20-Lead Ceramic Dual-In-Line Package (D)**  
**NS Package Number J20A**

J20A (REV M)

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

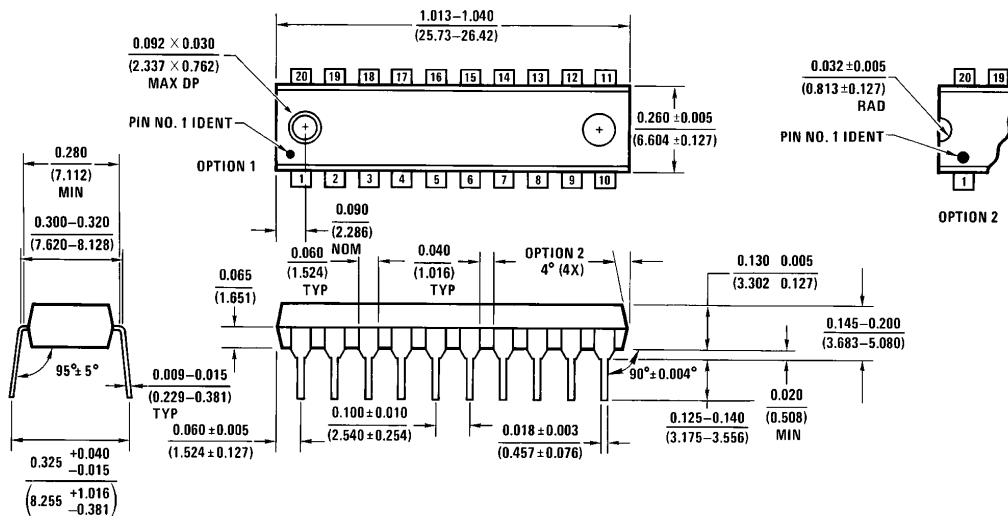


**20-Lead (0.300" Wide) Molded Small Outline Package, JEDEC (S)  
NS Package Number M20B**



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

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



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

N20A (REV G)

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



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

W20A (REV E)

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



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