

## CD4512BM/CD4512BC 8-Channel Buffered Data Selector

### General Description

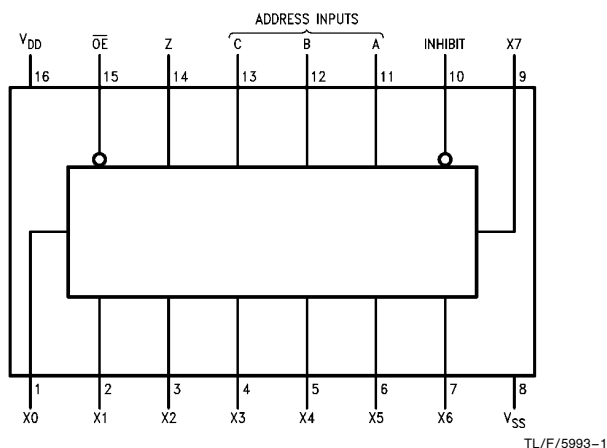
The CD4512BM/CD4512BC buffered 8-channel data selector is a complementary MOS (CMOS) circuit constructed with N- and P-channel enhancement mode transistors. This data selector is primarily used as a digital signal multiplexer selecting 1 of 8 inputs and routing the signal to a TRI-STATE® output. A high level at the Inhibit input forces a low level at the output. A high level at the Output Enable ( $\overline{OE}$ ) input forces the output into the TRI-STATE condition. Low levels at both the Inhibit and ( $\overline{OE}$ ) inputs allow normal operation.

### Features

- Wide supply voltage range 3.0V to 15V
- High noise immunity 0.45  $V_{DD}$  (typ.)
- TRI-STATE output
- Low quiescent power dissipation 0.25  $\mu W$ /package (typ.) @  $V_{CC} = 5.0V$
- Plug-in replacement for Motorola MC14512

### Connection Diagram and Truth Table

Dual-In-Line Package



Order Number CD4512B

TL/F/5993-1

Top View

| Address Inputs |   |   | Control Inputs |                 | Output |
|----------------|---|---|----------------|-----------------|--------|
| C              | B | A | Inhibit        | $\overline{OE}$ | Z      |
| 0              | 0 | 0 | 0              | 0               | X0     |
| 0              | 0 | 1 | 0              | 0               | X1     |
| 0              | 1 | 0 | 0              | 0               | X2     |
| 0              | 1 | 1 | 0              | 0               | X3     |
| 1              | 0 | 0 | 0              | 0               | X4     |
| 1              | 0 | 1 | 0              | 0               | X5     |
| 1              | 1 | 0 | 0              | 0               | X6     |
| 1              | 1 | 1 | 0              | 0               | X7     |
| ⓪              | ⓪ | ⓪ | 1              | 0               | 0      |
| ⓪              | ⓪ | ⓪ | ⓪              | 1               | Hi-Z   |

⓪ = Don't care

Hi-Z = TRI-STATE condition

Xn = Data at input n

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**Absolute Maximum Ratings** (Notes 1 & 2)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

|                                     |                                 |
|-------------------------------------|---------------------------------|
| Supply Voltage ( $V_{DD}$ )         | –0.5 to +18 $V_{DC}$            |
| Input Voltage ( $V_{IN}$ )          | –0.5 to $V_{DD}$ + 0.5 $V_{DC}$ |
| Storage Temperature Range ( $T_S$ ) | –65°C to +150°C                 |
| Power Dissipation ( $P_D$ )         |                                 |
| Dual-In-Line                        | 700 mW                          |
| Small Outline                       | 500 mW                          |
| Lead Temperature, ( $T_L$ )         |                                 |
| (Soldering, 10 seconds)             | 260°C                           |

**Recommended Operating Conditions** (Note 2)

|                                       |                        |
|---------------------------------------|------------------------|
| DC Supply Voltage ( $V_{DD}$ )        | 3.0 to 15 $V_{DC}$     |
| Input Voltage ( $V_{IN}$ )            | 0 to $V_{DD}$ $V_{DC}$ |
| Operating Temperature Range ( $T_A$ ) |                        |
| CD4512BM                              | –55°C to +125°C        |
| CD4512BC                              | –40°C to +85°C         |

**DC Electrical Characteristics** CD4512BM (Note 2)

| Symbol   | Parameter                          | Conditions                                                                                                                               | –55°C                  |                      | +25°C                 |                         |                      | +125°C                 |                      | Units                         |
|----------|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----------------------|-----------------------|-------------------------|----------------------|------------------------|----------------------|-------------------------------|
|          |                                    |                                                                                                                                          | Min                    | Max                  | Min                   | Typ                     | Max                  | Min                    | Max                  |                               |
| $I_{DD}$ | Quiescent Device Current           | $V_{DD} = 5V, V_{IN} = V_{DD}$ or $V_{SS}$<br>$V_{DD} = 10V, V_{IN} = V_{DD}$ or $V_{SS}$<br>$V_{DD} = 15V, V_{IN} = V_{DD}$ or $V_{SS}$ |                        | 5.0<br>10<br>20      |                       | 0.005<br>0.010<br>0.015 | 5.0<br>10<br>20      |                        | 150<br>300<br>600    | $\mu A$<br>$\mu A$<br>$\mu A$ |
| $V_{OL}$ | Low Level Output Voltage           | $V_{DD} = 5V$<br>$V_{DD} = 10V$<br>$V_{DD} = 15V$ } $ I_{OL}  < 1 \mu A$                                                                 |                        | 0.05<br>0.05<br>0.05 |                       | 0<br>0<br>0             | 0.05<br>0.05<br>0.05 |                        | 0.05<br>0.05<br>0.05 | V<br>V<br>V                   |
| $V_{OH}$ | High Level Output Voltage          | $V_{DD} = 5V$<br>$V_{DD} = 10V$<br>$V_{DD} = 15V$ } $ I_{OH}  < 1 \mu A$                                                                 | 4.95<br>9.95<br>14.95  |                      | 4.95<br>9.95<br>14.95 | 5.0<br>10.0<br>15.0     |                      | 4.95<br>9.95<br>14.95  |                      | V<br>V<br>V                   |
| $V_{IL}$ | Low Level Input Voltage            | $V_{DD} = 5V, V_O = 0.5V$<br>$V_{DD} = 10V, V_O = 1.0V$<br>$V_{DD} = 15V, V_O = 1.5V$                                                    |                        | 1.5<br>3.0<br>4.0    |                       | 2.25<br>4.50<br>6.75    | 1.5<br>3.0<br>4.0    |                        | 1.5<br>3.0<br>4.0    | V<br>V<br>V                   |
| $V_{IH}$ | High Level Input Voltage           | $V_{DD} = 5V, V_O = 4.5V$<br>$V_{DD} = 10V, V_O = 9.0V$<br>$V_{DD} = 15V, V_O = 13.5V$                                                   | 3.5<br>7.0<br>11.0     |                      | 3.5<br>7.0<br>11.0    | 2.75<br>5.50<br>8.25    |                      | 3.5<br>7.0<br>11.0     |                      | V<br>V<br>V                   |
| $I_{OL}$ | Low Level Output Current (Note 3)  | $V_{DD} = 5V, V_O = 0.4V$<br>$V_{DD} = 10V, V_O = 0.5V$<br>$V_{DD} = 15V, V_O = 1.5V$                                                    | 0.64<br>1.6<br>4.2     |                      | 0.51<br>1.3<br>3.4    | 0.78<br>2.0<br>7.8      |                      | 0.36<br>0.9<br>2.4     |                      | mA<br>mA<br>mA                |
| $I_{OH}$ | High Level Output Current (Note 3) | $V_{DD} = 5V, V_O = 4.6V$<br>$V_{DD} = 10V, V_O = 9.5V$<br>$V_{DD} = 15V, V_O = 13.5V$                                                   | –0.25<br>–0.62<br>–1.8 |                      | –0.2<br>–0.5<br>–1.5  |                         |                      | –0.14<br>–0.35<br>–1.1 |                      | mA<br>mA<br>mA                |
| $I_{IN}$ | Input Current                      | $V_{DD} = 15V, V_{IN} = 0V$<br>$V_{DD} = 15V, V_{IN} = 15V$                                                                              |                        | –0.1<br>0.1          |                       | $-10^{-5}$<br>$10^{-5}$ | –0.1<br>0.1          |                        | –1.0<br>1.0          | $\mu A$<br>$\mu A$            |
| $I_{OZ}$ | TRI-STATE Output Current           | $V_{DD} = 15V, V_O = 0V$<br>$V_{DD} = 15V, V_O = 15V$                                                                                    |                        | $\pm 0.1$            |                       | $-10^{-5}$              | $\pm 0.1$            |                        | $\pm 3.0$            | $\mu A$                       |

**DC Electrical Characteristics** CD4512BC (Note 2)

| Symbol   | Parameter                 | Conditions                                                                                                                               | –40°C                 |                      | +25°C                 |                         |                      | +85°C                 |                      | Units                         |
|----------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|----------------------|-----------------------|-------------------------|----------------------|-----------------------|----------------------|-------------------------------|
|          |                           |                                                                                                                                          | Min                   | Max                  | Min                   | Typ                     | Max                  | Min                   | Max                  |                               |
| $I_{DD}$ | Quiescent Device Current  | $V_{DD} = 5V, V_{IN} = V_{DD}$ or $V_{SS}$<br>$V_{DD} = 10V, V_{IN} = V_{DD}$ or $V_{SS}$<br>$V_{DD} = 15V, V_{IN} = V_{DD}$ or $V_{SS}$ |                       | 20<br>40<br>80       |                       | 0.005<br>0.010<br>0.015 | 20<br>40<br>80       |                       | 150<br>300<br>600    | $\mu A$<br>$\mu A$<br>$\mu A$ |
| $V_{OL}$ | Low Level Output Voltage  | $V_{DD} = 5V$<br>$V_{DD} = 10V$<br>$V_{DD} = 15V$ } $ I_{OL}  < 1 \mu A$                                                                 |                       | 0.05<br>0.05<br>0.05 |                       | 0<br>0<br>0             | 0.05<br>0.05<br>0.05 |                       | 0.05<br>0.05<br>0.05 | V<br>V<br>V                   |
| $V_{OH}$ | High Level Output Voltage | $V_{DD} = 5V$<br>$V_{DD} = 10V$<br>$V_{DD} = 15V$ } $ I_{OH}  < 1 \mu A$                                                                 | 4.95<br>9.95<br>14.95 |                      | 4.95<br>9.95<br>14.95 | 5.0<br>10.0<br>15.0     |                      | 4.95<br>9.95<br>14.95 |                      | V<br>V<br>V                   |
| $V_{IL}$ | Low Level Input Voltage   | $V_{DD} = 5V, V_O = 0.5V$<br>$V_{DD} = 10V, V_O = 1.0V$<br>$V_{DD} = 15V, V_O = 1.5V$                                                    |                       | 1.5<br>3.0<br>4.0    |                       | 2.25<br>4.50<br>6.75    | 1.5<br>3.0<br>4.0    |                       | 1.5<br>3.0<br>4.0    | V<br>V<br>V                   |

## DC Electrical Characteristics CD4512BC (Note 2) (Continued)

| Symbol          | Parameter                          | Conditions                                                                                | −40°C |      | +25°C |                   |      | +85°C |      | Units |
|-----------------|------------------------------------|-------------------------------------------------------------------------------------------|-------|------|-------|-------------------|------|-------|------|-------|
|                 |                                    |                                                                                           | Min   | Max  | Min   | Typ               | Max  | Min   | Max  |       |
| V <sub>IH</sub> | High Level Input Voltage           | V <sub>DD</sub> = 5V, V <sub>O</sub> = 4.5V                                               | 3.5   |      | 3.5   | 2.75              |      | 3.5   |      | V     |
|                 |                                    | V <sub>DD</sub> = 10V, V <sub>O</sub> = 9.0V                                              | 7.0   |      | 7.0   | 5.50              |      | 7.0   |      | V     |
|                 |                                    | V <sub>DD</sub> = 15V, V <sub>O</sub> = 13.5V                                             | 11.0  |      | 11.0  | 8.25              |      | 11.0  |      | V     |
| I <sub>OL</sub> | Low Level Output Current (Note 3)  | V <sub>DD</sub> = 5V, V <sub>O</sub> = 0.4V                                               | 0.52  |      | 0.44  | 0.78              |      | 0.36  |      | mA    |
|                 |                                    | V <sub>DD</sub> = 10V, V <sub>O</sub> = 0.5V                                              | 1.3   |      | 1.1   | 2.0               |      | 0.9   |      | mA    |
|                 |                                    | V <sub>DD</sub> = 15V, V <sub>O</sub> = 1.5V                                              | 3.6   |      | 3.4   | 7.8               |      | 2.4   |      | mA    |
| I <sub>OH</sub> | High Level Output Current (Note 3) | V <sub>DD</sub> = 5V, V <sub>O</sub> = 4.6V                                               | −0.2  |      | −0.16 |                   |      | −0.12 |      | mA    |
|                 |                                    | V <sub>DD</sub> = 10V, V <sub>O</sub> = 9.5                                               | −0.5  |      | −0.4  |                   |      | −0.3  |      | mA    |
|                 |                                    | V <sub>DD</sub> = 15V, V <sub>O</sub> = 13.5V                                             | −1.4  |      | −1.2  |                   |      | −1.0  |      | mA    |
| I <sub>IN</sub> | Input Current                      | V <sub>DD</sub> = 15V, V <sub>IN</sub> = 0V                                               |       | −0.3 |       | −10 <sup>−5</sup> | −0.3 |       | −1.0 | μA    |
|                 |                                    | V <sub>DD</sub> = 15V, V <sub>IN</sub> = 15V                                              |       | 0.3  |       | 10 <sup>−5</sup>  | 0.3  |       | 1.0  | μA    |
| I <sub>OZ</sub> | TRI-STATE Output Current           | V <sub>DD</sub> = 15V, V <sub>O</sub> = 0V<br>V <sub>DD</sub> = 15V, V <sub>O</sub> = 15V |       | ±1.0 |       | ±10 <sup>−5</sup> | ±1.0 |       | ±7.5 | μA    |

## AC Electrical Characteristics\* T<sub>A</sub> = 25°C, t<sub>r</sub> = t<sub>f</sub> = 20 ns, C<sub>L</sub> = 50 pF

| Symbol                              | Parameter                                         | Conditions            | CD4512BM |     |     | CD4512BC |     |     | Units |
|-------------------------------------|---------------------------------------------------|-----------------------|----------|-----|-----|----------|-----|-----|-------|
|                                     |                                                   |                       | Min      | Typ | Max | Min      | Typ | Max |       |
| t <sub>PHL</sub>                    | Propagation Delay High-to-Low Level               | V <sub>DD</sub> = 5V  |          | 225 | 500 |          | 225 | 750 | ns    |
|                                     |                                                   | V <sub>DD</sub> = 10V |          | 75  | 175 |          | 75  | 200 | ns    |
|                                     |                                                   | V <sub>DD</sub> = 15V |          | 57  | 130 |          | 57  | 150 | ns    |
| t <sub>PLH</sub>                    | Propagation Delay Low-to-High Level               | V <sub>DD</sub> = 5V  |          | 225 | 500 |          | 225 | 750 | ns    |
|                                     |                                                   | V <sub>DD</sub> = 10V |          | 75  | 175 |          | 75  | 200 | ns    |
|                                     |                                                   | V <sub>DD</sub> = 15V |          | 57  | 130 |          | 57  | 150 | ns    |
| t <sub>THL</sub> , t <sub>TLH</sub> | Transition Time                                   | V <sub>DD</sub> = 5V  |          | 70  | 200 |          | 70  | 200 | ns    |
|                                     |                                                   | V <sub>DD</sub> = 10V |          | 35  | 100 |          | 35  | 100 | ns    |
|                                     |                                                   | V <sub>DD</sub> = 15V |          | 25  | 80  |          | 25  | 80  | ns    |
| t <sub>PHZ</sub> , t <sub>PLZ</sub> | Propagation Delay into TRI-STATE from Logic Level | V <sub>DD</sub> = 5V  |          | 50  | 125 |          | 50  | 125 | ns    |
|                                     |                                                   | V <sub>DD</sub> = 10V |          | 25  | 75  |          | 25  | 75  | ns    |
|                                     |                                                   | V <sub>DD</sub> = 15V |          | 19  | 60  |          | 19  | 60  | ns    |
| t <sub>PZH</sub> , t <sub>PZL</sub> | Propagation Delay to Logic Level from TRI-STATE   | V <sub>DD</sub> = 5V  |          | 50  | 125 |          | 50  | 125 | ns    |
|                                     |                                                   | V <sub>DD</sub> = 10V |          | 25  | 75  |          | 25  | 75  | ns    |
|                                     |                                                   | V <sub>DD</sub> = 15V |          | 19  | 60  |          | 19  | 60  | ns    |
| C <sub>IN</sub>                     | Input Capacitance                                 | (Note 4)              |          | 7.5 | 15  |          | 7.5 | 15  | pF    |
| C <sub>OUT</sub>                    | TRI-STATE Output Capacitance                      | (Note 4)              |          | 7.5 | 15  |          | 7.5 | 15  | pF    |
| C <sub>PD</sub>                     | Power Dissipation Capacity                        | (Note 5)              |          | 150 |     |          | 150 |     | pF    |

\*AC Parameters are guaranteed by DC correlated testing.

**Note 1:** "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The tables of "Recommended Operating Conditions" and "Electrical Characteristics" provide conditions for actual device operation.

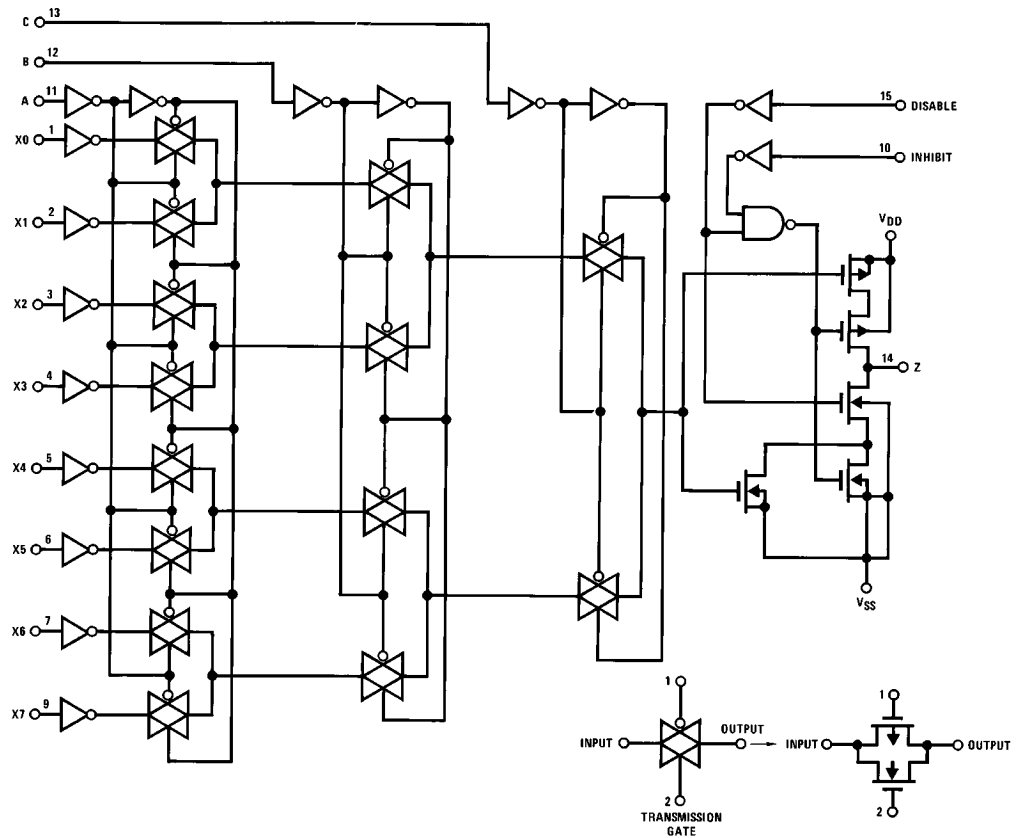
**Note 2:** V<sub>SS</sub> = 0V unless otherwise specified.

**Note 3:** I<sub>OH</sub> and I<sub>OL</sub> are tested one output at a time.

**Note 4:** Capacitance guaranteed by periodic testing.

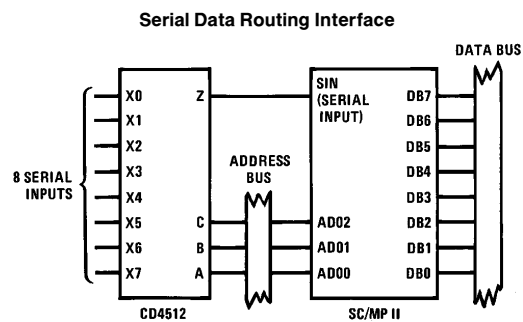
**Note 5:** C<sub>PD</sub> determines the no load AC power of any CMOS device. For complete explanation, see 54C/74C Family Characteristics Application Note, AN-90.

### Logic Diagram



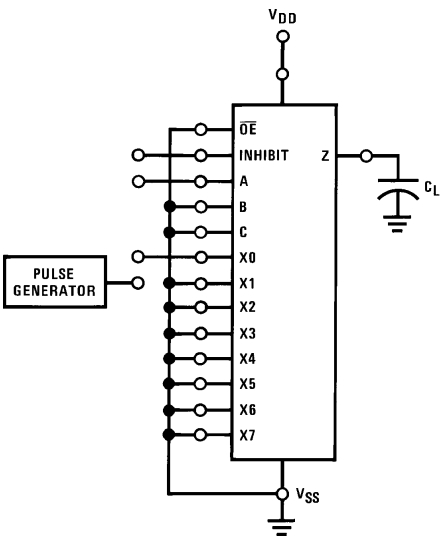
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## Typical Application

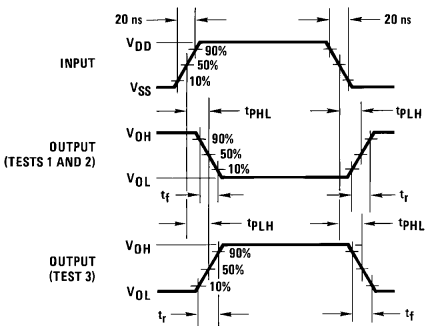


TL/F/5993-3

AC Test Circuit and Switching Time Waveforms



TL/F/5993-4

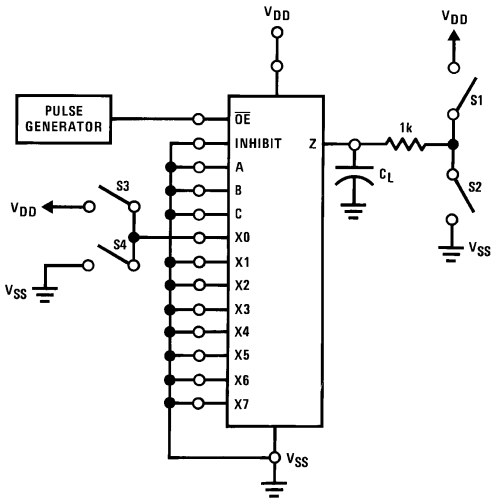


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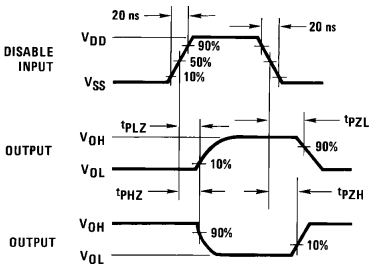
Input Connections for  $t_r$ ,  $t_f$ ,  $t_{PLH}$ ,  $t_{PHL}$

| Test | Inhibit | A   | X0              |
|------|---------|-----|-----------------|
| 1    | PG      | GND | V <sub>DD</sub> |
| 2    | GND     | PG  | V <sub>DD</sub> |
| 3    | GND     | GND | PG              |

TRI-STATE AC Test Circuit and Switching Time Waveforms



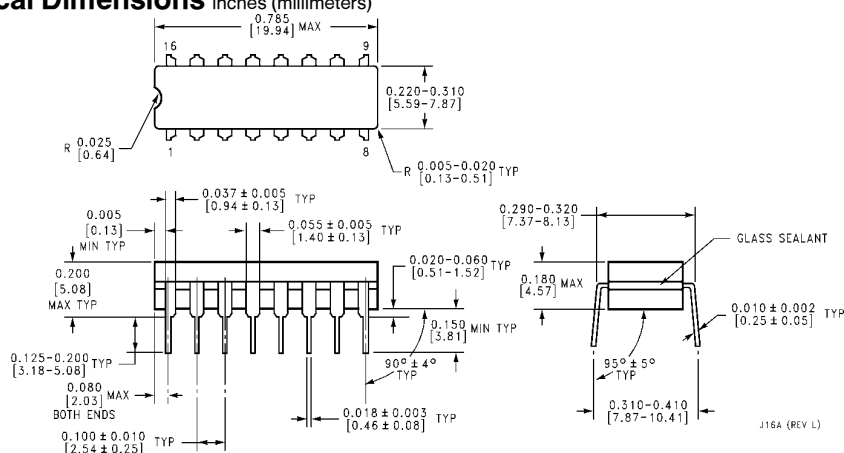
TL/F/5993-6



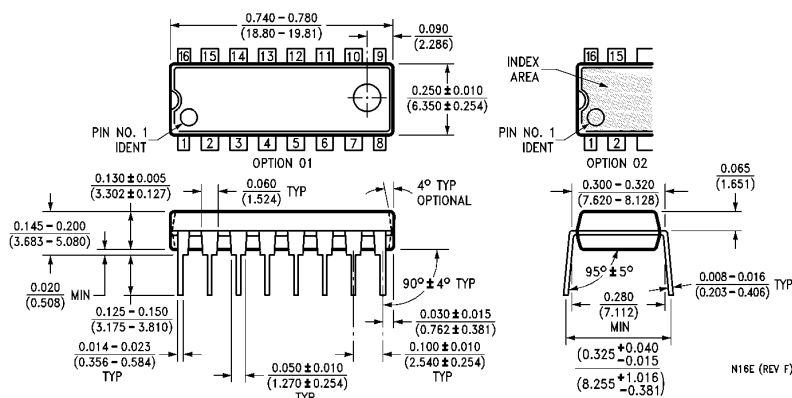
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Switch Positions for TRI-STATE Test

| Test      | S1     | S2     | S3     | S4     |
|-----------|--------|--------|--------|--------|
| $t_{PHZ}$ | Open   | Closed | Closed | Open   |
| $t_{PLZ}$ | Closed | Open   | Open   | Closed |
| $t_{PZH}$ | Closed | Open   | Open   | Closed |
| $t_{PZL}$ | Open   | Closed | Closed | Open   |

**Physical Dimensions** inches (millimeters)

**Ceramic Dual-In-Line Package (J)**  
**Order Number CD4512BMJ or CD4512BCJ**  
**NS Package Number J16A**



**Molded Dual-In-Line Package (N)**  
**Order Number CD4512BMN or CD4512BCN**  
**NS Package Number N16E**

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