

June 1989

## 54150/DM54150/DM74150, 54151A/DM54151A/DM74151A Data Selectors/Multiplexers

### General Description

These data selectors/multiplexers contain full on-chip decoding to select the desired data source. The 150 selects one-of-sixteen data sources; the 151A selects one-of-eight data sources. The 150 and 151A have a strobe input which must be at a low logic level to enable these devices. A high level at the strobe forces the W output high and the Y output (as applicable) low.

The 151A features complementary W and Y outputs, whereas the 150 has an inverted (W) output only.

The 151A incorporates address buffers which have symmetrical propagation delay times through the complementary paths. This reduces the possibility of transients occurring at the output(s) due to changes made at the select inputs, even when the 151A outputs are enabled (i.e., strobe low).

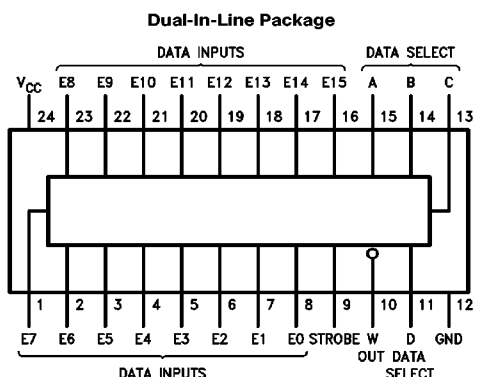
### Features

- 150 selects one-of-sixteen data lines
- 151A selects one-of-eight data lines
- Performs parallel-to-serial conversion
- Permits multiplexing from N lines to one line
- Also for use as Boolean function generator
- Typical average propagation delay time, data input to W output
 

|      |       |
|------|-------|
| 150  | 11 ns |
| 151A | 9 ns  |
- Typical power dissipation
 

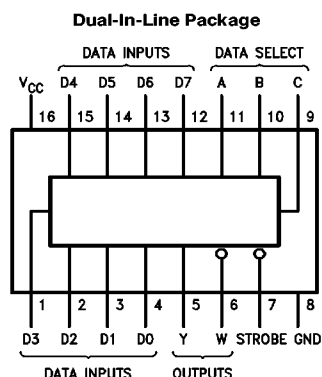
|      |        |
|------|--------|
| 150  | 200 mW |
| 151A | 135 mW |
- Alternate Military/Aerospace device (54150, 54151A) is available. Contact a National Semiconductor Sales Office/Distributor for specifications.

### Connection Diagrams



Order Number 54150DQMB, 54150FMQB,  
DM54150J or DM74150N  
See NS Package Number J24A, N24A or W24C

TL/F/6546-1



Order Number 54151ADMQB, 54151AFMQB,  
DM54151AJ, DM54151AW or DM74151AN  
See NS Package Number J16A, N16E or W16A

TL/F/6546-2

## Absolute Maximum Ratings (Note)

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

|                                      |                 |
|--------------------------------------|-----------------|
| Supply Voltage                       | 7V              |
| Input Voltage                        | 5.5V            |
| Operating Free Air Temperature Range |                 |
| DM54 and 54                          | −55°C to +125°C |
| DM74                                 | 0°C to +70°C    |
| Storage Temperature Range            | −65°C to +150°C |

Note: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the "Electrical Characteristics" table are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

## Recommended Operating Conditions

| Symbol          | Parameter                      | DM54150 |     |      | DM74150 |     |      | Units |
|-----------------|--------------------------------|---------|-----|------|---------|-----|------|-------|
|                 |                                | Min     | Nom | Max  | Min     | Nom | Max  |       |
| V <sub>CC</sub> | Supply Voltage                 | 4.5     | 5   | 5.5  | 4.75    | 5   | 5.25 | V     |
| V <sub>IH</sub> | High Level Input Voltage       | 2       |     |      | 2       |     |      | V     |
| V <sub>IL</sub> | Low Level Input Voltage        |         |     | 0.8  |         |     | 0.8  | V     |
| I <sub>OH</sub> | High Level Output Current      |         |     | −0.8 |         |     | −0.8 | mA    |
| I <sub>OL</sub> | Low Level Output Current       |         |     | 16   |         |     | 16   | mA    |
| T <sub>A</sub>  | Free Air Operating Temperature | −55     |     | 125  | 0       |     | 70   | °C    |

## 150 Electrical Characteristics

over recommended operating free air temperature range (unless otherwise noted)

| Symbol          | Parameter                         | Conditions                                                                                   | Min                        | Typ<br>(Note 1) | Max        | Units |
|-----------------|-----------------------------------|----------------------------------------------------------------------------------------------|----------------------------|-----------------|------------|-------|
| V <sub>I</sub>  | Input Clamp Voltage               | V <sub>CC</sub> = Min, I <sub>I</sub> = −12 mA                                               |                            |                 | −1.5       | V     |
| V <sub>OH</sub> | High Level Output Voltage         | V <sub>CC</sub> = Min, I <sub>OH</sub> = Max<br>V <sub>IL</sub> = Max, V <sub>IH</sub> = Min | 2.4                        |                 |            | V     |
| V <sub>OL</sub> | Low Level Output Voltage          | V <sub>CC</sub> = Min, I <sub>OL</sub> = Max<br>V <sub>IH</sub> = Min, V <sub>IL</sub> = Max |                            |                 | 0.4        | V     |
| I <sub>I</sub>  | Input Current @ Max Input Voltage | V <sub>CC</sub> = Max, V <sub>I</sub> = 5.5V                                                 |                            |                 | 1          | mA    |
| I <sub>IH</sub> | High Level Input Current          | V <sub>CC</sub> = Max, V <sub>I</sub> = 2.4V                                                 |                            |                 | 40         | μA    |
| I <sub>IL</sub> | Low Level Input Current           | V <sub>CC</sub> = Max, V <sub>I</sub> = 0.4V                                                 |                            |                 | −1.6       | mA    |
| I <sub>OS</sub> | Short Circuit Output Current      | V <sub>CC</sub> = Max<br>(Note 2)                                                            | DM54<br>−20<br>DM74<br>−18 |                 | −55<br>−55 | mA    |
| I <sub>CC</sub> | Supply Current                    | V <sub>CC</sub> = Max, (Note 3)                                                              |                            | 40              | 68         | mA    |

Note 1: All typicals are at V<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C.

Note 2: Not more than one output should be shorted at a time.

Note 3: I<sub>CC</sub> is measured with the strobe and data select inputs at 4.5V, all other inputs and outputs open.

| '150 Switching Characteristics                                                                       |                                                    |                             |                                               |     |       |
|------------------------------------------------------------------------------------------------------|----------------------------------------------------|-----------------------------|-----------------------------------------------|-----|-------|
| at V <sub>CC</sub> = 5V and T <sub>A</sub> = 25°C (See Section 1 for Test Waveforms and Output Load) |                                                    |                             |                                               |     |       |
| Symbol                                                                                               | Parameter                                          | From (Input)<br>To (Output) | R <sub>L</sub> = 400Ω, C <sub>L</sub> = 15 pF |     | Units |
|                                                                                                      |                                                    |                             | Min                                           | Max |       |
| t <sub>PLH</sub>                                                                                     | Propagation Delay Time<br>Low to High Level Output | Select<br>to W              |                                               | 35  | ns    |
| t <sub>PHL</sub>                                                                                     | Propagation Delay Time<br>High to Low Level Output | Select<br>to W              |                                               | 33  | ns    |
| t <sub>PLH</sub>                                                                                     | Propagation Delay Time<br>Low to High Level Output | Strobe<br>to W              |                                               | 24  | ns    |
| t <sub>PHL</sub>                                                                                     | Propagation Delay Time<br>High to Low Level Output | Strobe<br>to W              |                                               | 30  | ns    |
| t <sub>PLH</sub>                                                                                     | Propagation Delay Time<br>Low to High Level Output | E0-E15<br>to W              |                                               | 20  | ns    |
| t <sub>PHL</sub>                                                                                     | Propagation Delay Time<br>High to Low Level Output | E0-E15<br>to W              |                                               | 14  | ns    |

| Recommended Operating Conditions |                                |          |     |      |          |     |      |       |
|----------------------------------|--------------------------------|----------|-----|------|----------|-----|------|-------|
| Symbol                           | Parameter                      | DM54151A |     |      | DM74151A |     |      | Units |
|                                  |                                | Min      | Nom | Max  | Min      | Nom | Max  |       |
| V <sub>CC</sub>                  | Supply Voltage                 | 4.5      | 5   | 5.5  | 4.75     | 5   | 5.25 | V     |
| V <sub>IH</sub>                  | High Level Input Voltage       | 2        |     |      | 2        |     |      | V     |
| V <sub>IL</sub>                  | Low Level Input Voltage        |          |     | 0.8  |          |     | 0.8  | V     |
| I <sub>OH</sub>                  | High Level Output Current      |          |     | −0.8 |          |     | −0.8 | mA    |
| I <sub>OL</sub>                  | Low Level Output Current       |          |     | 16   |          |     | 16   | mA    |
| T <sub>A</sub>                   | Free Air Operating Temperature | −55      |     | 125  | 0        |     | 70   | °C    |

### '151A Electrical Characteristics

over recommended operating free air temperature range (unless otherwise noted)

| Symbol   | Parameter                         | Conditions                                                                               | Min                        | Typ<br>(Note 1) | Max        | Units         |
|----------|-----------------------------------|------------------------------------------------------------------------------------------|----------------------------|-----------------|------------|---------------|
| $V_I$    | Input Clamp Voltage               | $V_{CC} = \text{Min}, I_I = -12 \text{ mA}$                                              |                            |                 | -1.5       | V             |
| $V_{OH}$ | High Level Output Voltage         | $V_{CC} = \text{Min}, I_{OH} = \text{Max}$<br>$V_{IL} = \text{Max}, V_{IH} = \text{Min}$ | 2.4                        |                 |            | V             |
| $V_{OL}$ | Low Level Output Voltage          | $V_{CC} = \text{Min}, I_{OL} = \text{Max}$<br>$V_{IH} = \text{Min}, V_{IL} = \text{Max}$ |                            |                 | 0.4        | V             |
| $I_I$    | Input Current @ Max Input Voltage | $V_{CC} = \text{Max}, V_I = 5.5 \text{ V}$                                               |                            |                 | 1          | mA            |
| $I_{IH}$ | High Level Input Current          | $V_{CC} = \text{Max}, V_I = 2.4 \text{ V}$                                               |                            |                 | 40         | $\mu\text{A}$ |
| $I_{IL}$ | Low Level Input Current           | $V_{CC} = \text{Max}, V_I = 0.4 \text{ V}$                                               |                            |                 | -1.6       | mA            |
| $I_{OS}$ | Short Circuit Output Current      | $V_{CC} = \text{Max}$<br>(Note 2)                                                        | DM54<br>-20<br>DM74<br>-18 |                 | -55<br>-55 | mA            |
| $I_{CC}$ | Supply Current                    | $V_{CC} = \text{Max}, \text{(Note 3)}$                                                   |                            | 27              | 48         | mA            |

**Note 1:** All typicals are at  $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$ .

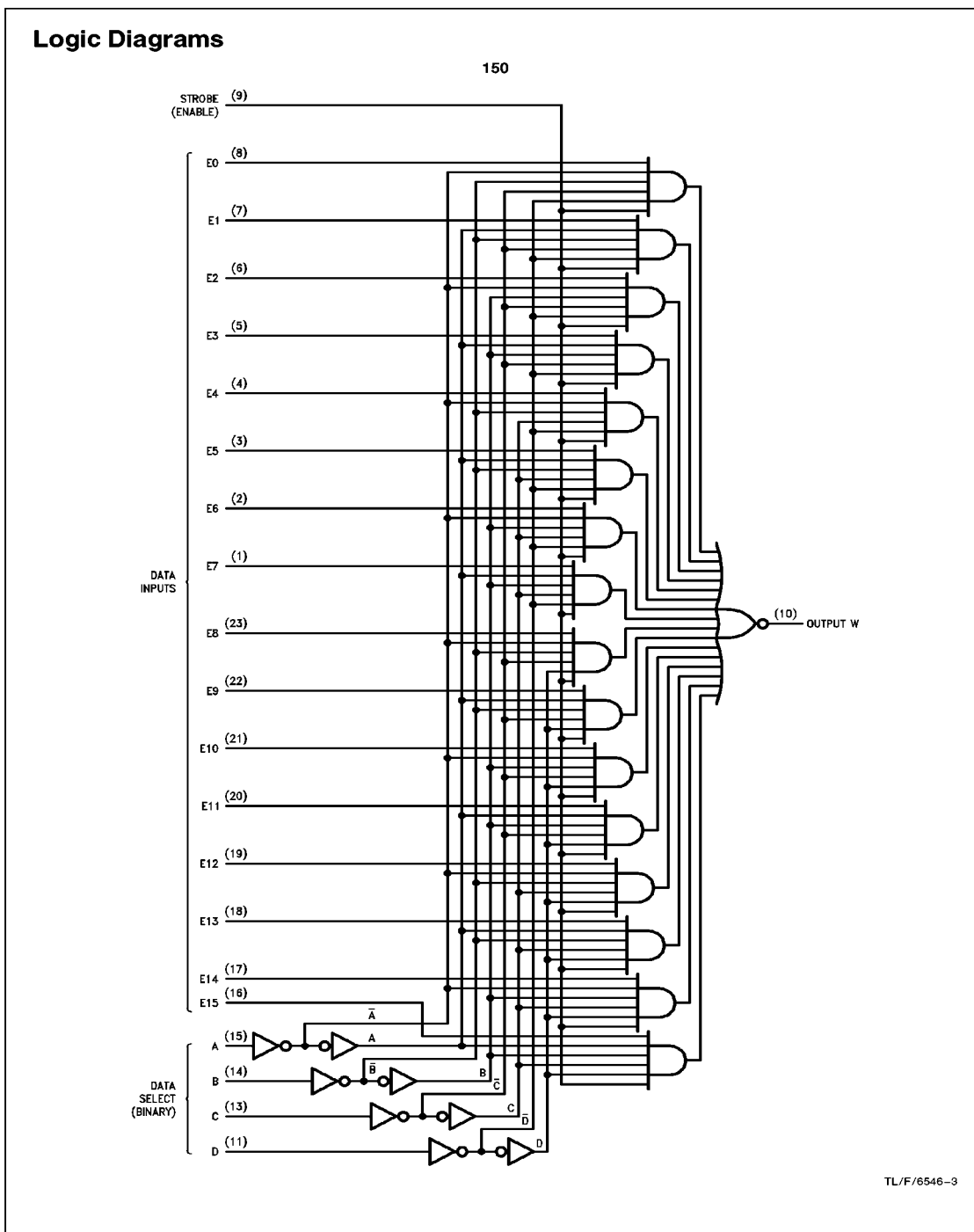
**Note 2:** Not more than one output should be shorted at a time.

**Note 3:**  $I_{CC}$  is measured with the strobe and data select inputs at 4.5V, all other inputs and outputs open.

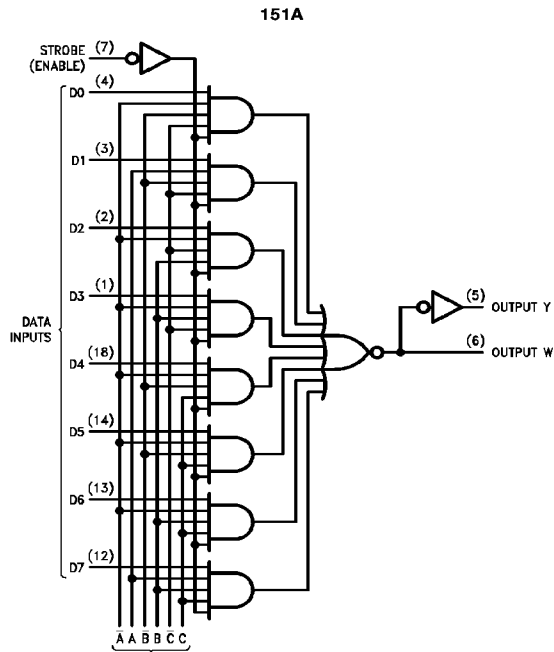
### '151A Switching Characteristics

at  $V_{CC} = 5 \text{ V}$  and  $T_A = 25^\circ\text{C}$  (See Section 1 for Test Waveforms and Output Load)

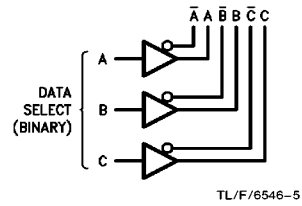
| Symbol    | Parameter                                          | From (Input)<br>To (Output) | $R_L = 400\Omega, C_L = 15 \text{ pF}$ |     | Units |
|-----------|----------------------------------------------------|-----------------------------|----------------------------------------|-----|-------|
|           |                                                    |                             | Min                                    | Max |       |
| $t_{PLH}$ | Propagation Delay Time<br>Low to High Level Output | Select<br>(4 Levels) to Y   |                                        | 38  | ns    |
| $t_{PHL}$ | Propagation Delay Time<br>High to Low Level Output | Select<br>(4 Levels) to Y   |                                        | 30  | ns    |
| $t_{PLH}$ | Propagation Delay Time<br>Low to High Level Output | Select<br>(3 Levels) to W   |                                        | 26  | ns    |
| $t_{PHL}$ | Propagation Delay Time<br>High to Low Level Output | Select<br>(3 Levels) to W   |                                        | 30  | ns    |
| $t_{PLH}$ | Propagation Delay Time<br>Low to High Level Output | Strobe<br>to Y              |                                        | 33  | ns    |
| $t_{PHL}$ | Propagation Delay Time<br>High to Low Level Output | Strobe<br>to Y              |                                        | 30  | ns    |
| $t_{PLH}$ | Propagation Delay Time<br>Low to High Level Output | Strobe<br>to W              |                                        | 21  | ns    |
| $t_{PHL}$ | Propagation Delay Time<br>High to Low Level Output | Strobe<br>to W              |                                        | 25  | ns    |
| $t_{PLH}$ | Propagation Delay Time<br>Low to High Level Output | D0-D7<br>to Y               |                                        | 24  | ns    |
| $t_{PHL}$ | Propagation Delay Time<br>High to Low Level Output | D0-D7<br>to Y               |                                        | 24  | ns    |
| $t_{PLH}$ | Propagation Delay Time<br>Low to High Level Output | D0-D7<br>to W               |                                        | 14  | ns    |
| $t_{PHL}$ | Propagation Delay Time<br>High to Low Level Output | D0-D7<br>to W               |                                        | 14  | ns    |



## Logic Diagrams



**Address Buffers for 54151A/74151A**



See Address Buffers Below

TL/F/6546-4

## Function Tables

**54150/74150**

| Inputs |   |   |   |   | Strobe<br>S      | Outputs<br>W |
|--------|---|---|---|---|------------------|--------------|
| Select |   |   |   |   |                  |              |
| D      | C | B | A |   |                  |              |
| X      | X | X | X | H | H                |              |
| L      | L | L | L | L | $\overline{E0}$  |              |
| L      | L | L | H | L | $\overline{E1}$  |              |
| L      | L | H | L | L | $\overline{E2}$  |              |
| L      | L | H | H | L | $\overline{E3}$  |              |
| L      | H | L | L | L | $\overline{E4}$  |              |
| L      | H | L | H | L | $\overline{E5}$  |              |
| L      | H | H | L | L | $\overline{E6}$  |              |
| L      | H | H | H | L | $\overline{E7}$  |              |
| H      | L | L | L | L | $\overline{E8}$  |              |
| H      | L | L | H | L | $\overline{E9}$  |              |
| H      | L | H | L | L | $\overline{E10}$ |              |
| H      | L | H | H | L | $\overline{E11}$ |              |
| H      | H | L | L | L | $\overline{E12}$ |              |
| H      | H | L | H | L | $\overline{E13}$ |              |
| H      | H | H | L | L | $\overline{E14}$ |              |
| H      | H | H | H | L | $\overline{E15}$ |              |

H = High Level, L = Low Level, X = Don't Care

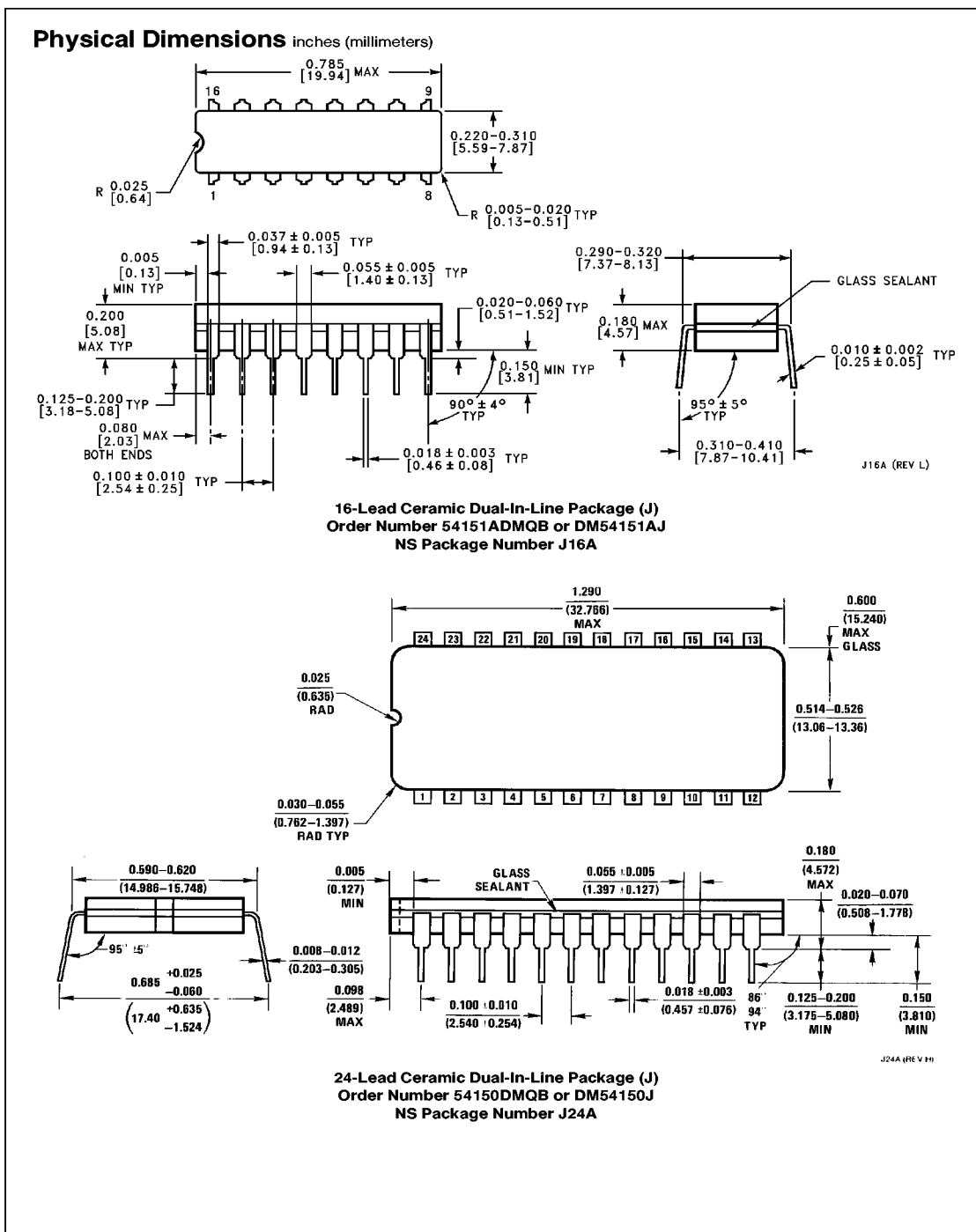
$\overline{E0}, \overline{E1} \dots \overline{E15}$  = the complement of the level of the respective E input

**54151A/75151A**

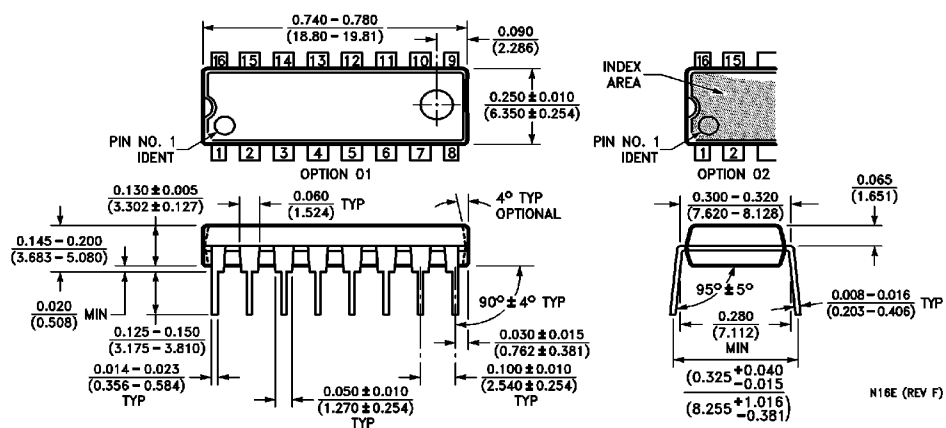
| Inputs |   |   |             | Outputs |                 |
|--------|---|---|-------------|---------|-----------------|
| Select |   |   |             | Y       | W               |
| C      | B | A | Strobe<br>S |         |                 |
| X      | X | X | H           | L       | H               |
| L      | L | L | L           | D0      | $\overline{D0}$ |
| L      | L | H | L           | D1      | $\overline{D1}$ |
| L      | H | L | L           | D2      | $\overline{D2}$ |
| L      | H | H | L           | D3      | $\overline{D3}$ |
| H      | L | L | L           | D4      | $\overline{D4}$ |
| H      | L | H | L           | D5      | $\overline{D5}$ |
| H      | H | L | L           | D6      | $\overline{D6}$ |
| H      | H | H | L           | D7      | $\overline{D7}$ |

H = High Level, L = Low Level, X = Don't Care

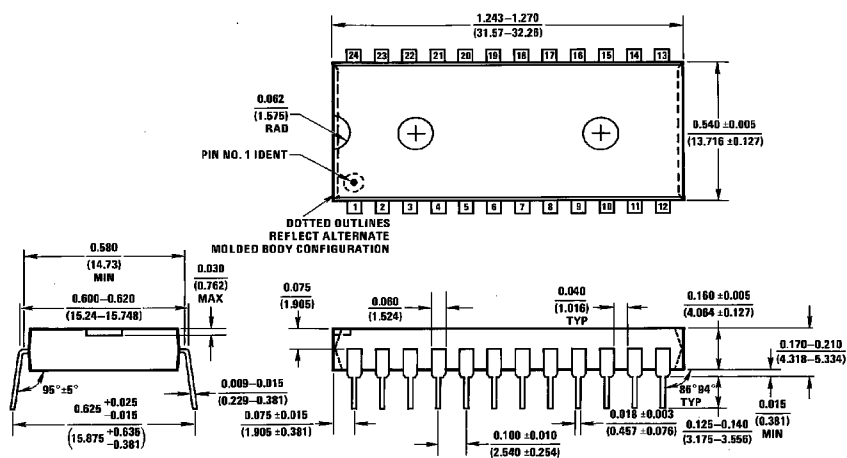
D0, D1 ... D7 = the level of the respective D input



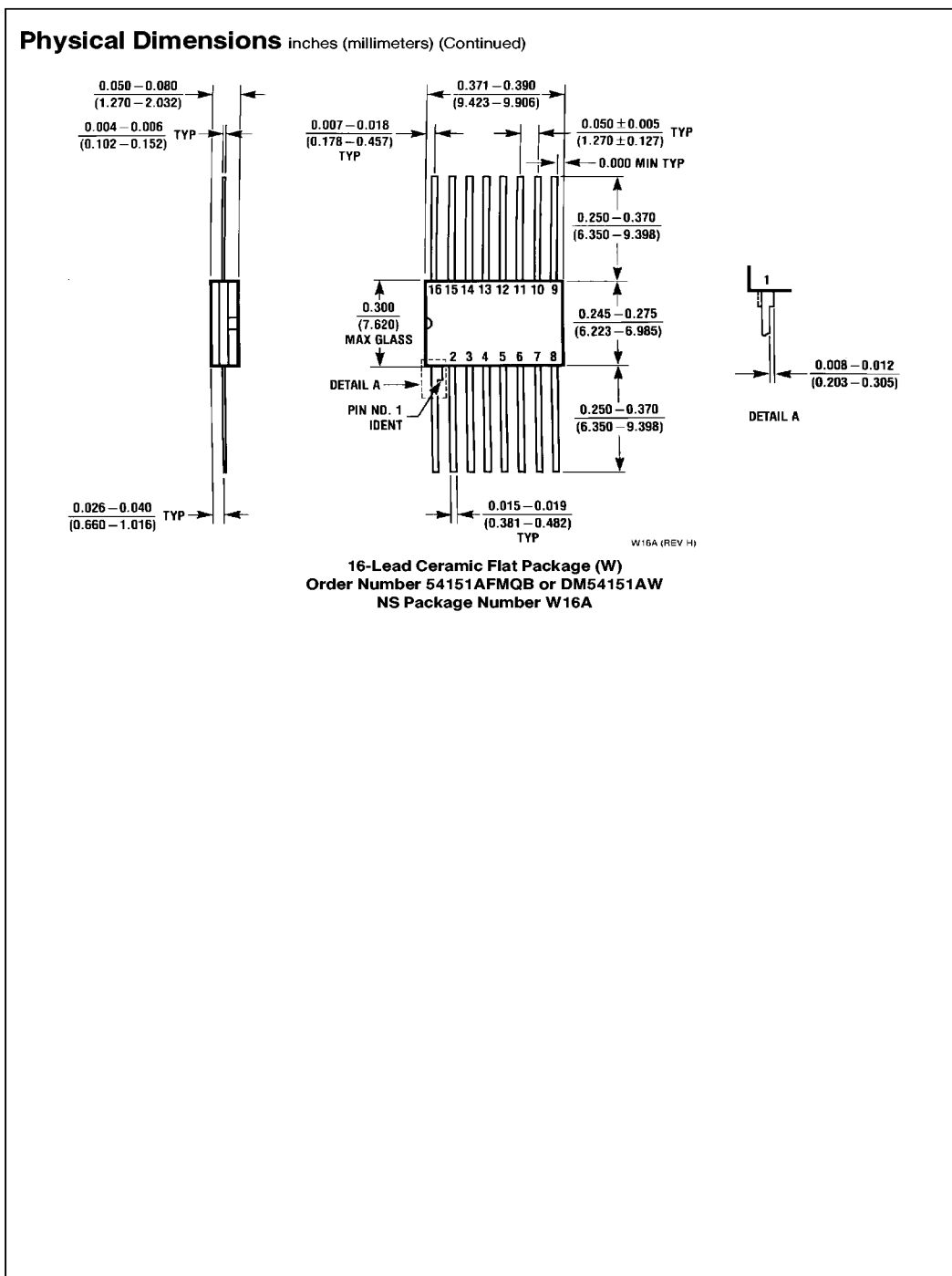
0.740-0.780



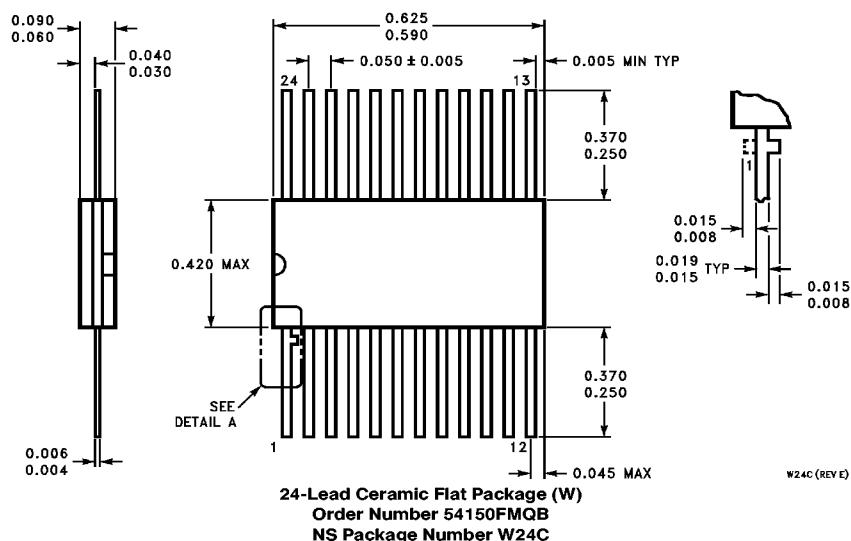
**16-Lead Molded Dual-In-Line Package (N)**  
**Order Number DM74151AN**  
**NS Package Number N16E**



**24-Lead Molded Dual-In-Line Package (N)**  
**Order Number DM74150N**  
**NS Package Number N24A**



# Physical Dimensions inches (millimeters) (Continued)



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