

# DM74LS465 (DM81LS95A)/DM74LS466 (DM81LS96A)/ DM74LS467 (DM81LS97A)/DM74LS468 (DM81LS98A) TRI-STATE® Octal Buffer

## General Description

These devices provide eight, two-input buffers in each package. All employ the newest low-power-Schottky TTL technology. One of the two inputs to each buffer is used as a control line to gate the output into the high-impedance state, while the other input passes the data through the buffer. The 'LS465 and 'LS467 present true data at the outputs, while the 'LS466 and 'LS468 are inverting. On the 'LS465 and 'LS466 versions, all eight TRI-STATE enable lines are common, with access through a 2-input NOR gate. On the 'LS467 and 'LS468 versions, four buffers are enabled from one common line, and the other four buffers are enabled from another common line. In all cases the outputs are placed in the TRI-STATE condition by applying a high logic level to the enable pins. These devices represent octal, low

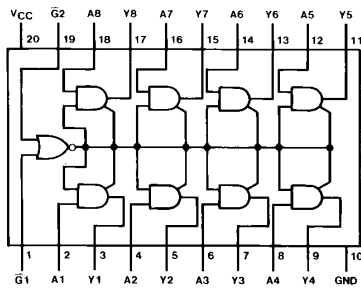
power-Schottky versions of the very popular DM54/74365, 366, 367, and 368 (DM8095, 96, 97, and 98) TRI-STATE hex buffers.

## Features

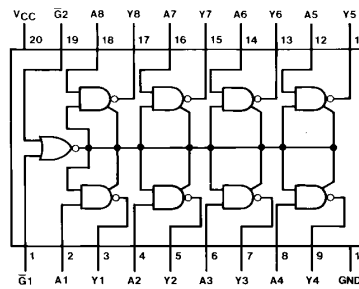
- Octal versions of popular DM74365, 366, 367, and 368 (DM8095, 96, 97 and 98)
- Typical power dissipation
  - LS465, 467, (LS95A, 97A) 80 mW
  - LS466, 468, (LS96A, 98A) 65 mW
- Typical propagation delay
  - LS465, 467 (LS95A, 97A) 15 ns
  - LS466, 468 (LS96A, 98A) 10 ns
- Low power-Schottky, TRI-STATE technology

## Connection Diagrams

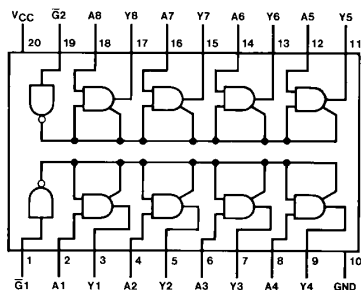
### Dual-In-Line Packages



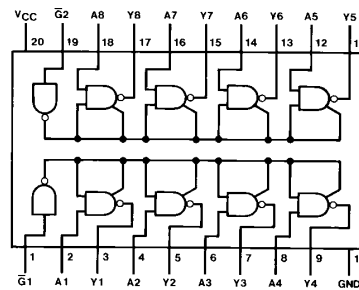
TL/F/6435-1



TL/F/6435-2



TL/F/6435-3



TL/F/6435-4

**Order Numbers DM74LS465WM/DM81LS95AWM, DM74LS465N/DM81LS95AN,  
DM74LS466WM/DM81LS96AWM, DM74LS466N/DM81LS96AN,  
DM74LS467WM/DM81LS97AWM, DM74LS467N/DM81LS97AN,  
DM74LS468WM/DM81LS98AWM or DM74LS468N/DM81LS98AN  
See NS Package Number M20B or N20A**

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DM74LS465 (DM81LS95A)/DM74LS466 (DM81LS96A)/DM74LS467 (DM81LS97A)/  
DM74LS468 (DM81LS98A) TRI-STATE Octal Buffer

## Absolute Maximum Ratings (Note)

|   |                 |
|---|-----------------|
| Supply Voltage  | 7V              |
| Input Voltage   | 7V              |
| Operating Free Air Temperature Range<br>DM74LS/DM81LS | 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                      | Min  | Nom | Max  | Units |
|-----------------|--------------------------------|------|-----|------|-------|
| V <sub>CC</sub> | Supply Voltage                 | 4.75 | 5   | 5.25 | V     |
| V <sub>IH</sub> | High Level Input Voltage       | 2    |     |      | V     |
| V <sub>IL</sub> | Low Level Input Voltage        |      |     | 0.8  | V     |
| I <sub>OH</sub> | High Level Output Current      |      |     | -5.2 | mA    |
| I <sub>OL</sub> | Low Level Output Current       |      |     | 24   | mA    |
| T <sub>A</sub>  | Free Air Operating Temperature | 0    |     | 70   | °C    |

## 'LS465 ('LS95A) and 'LS467 ('LS97A) 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> = -18 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 | 2.7                   |                 |      | V     |    |
| V <sub>OL</sub>  | Low Level Output Voltage  | V <sub>CC</sub> = Min, I <sub>OL</sub> = Max<br>V <sub>IL</sub> = Max, V <sub>IH</sub> = Min |                       |                 | 0.5  | V     |    |
|                  |   | I <sub>OL</sub> = 12 mA, V <sub>CC</sub> = Min   |                       |                 | 0.4  |       |    |
| I <sub>I</sub>   | Input Current @Max Input Voltage                                | V <sub>CC</sub> = Max, V <sub>I</sub> = 7V   |                       |                 | 0.1  | mA    |    |
| I <sub>IH</sub>  | High Level Input Current  | V <sub>CC</sub> = Max, V <sub>I</sub> = 2.7V   |                       |                 | 20   | μA    |    |
| I <sub>IL</sub>  | Low Level Input Current   | V <sub>CC</sub> = Max  | V <sub>I</sub> = 0.5V | A (Note 3)      |      | -20   | μA |
|                  |   |  | V <sub>I</sub> = 0.4V | A (Note 4)      |      | -50   |    |
|                  |   |  | $\bar{G}$             |                 |      | -50   |    |
| I <sub>OZH</sub> | Off-State Output Current with High Level Output Voltage Applied | V <sub>CC</sub> = Max, V <sub>O</sub> = 2.4V<br>V <sub>IH</sub> = Min, V <sub>IL</sub> = Max |                       |                 | 20   | μA    |    |
| I <sub>OZL</sub> | Off-State Output Current with Low Level Output Voltage Applied  | V <sub>CC</sub> = Max, V <sub>O</sub> = 0.4V<br>V <sub>IH</sub> = Min, V <sub>IL</sub> = Max |                       |                 | -20  | μA    |    |
| I <sub>OS</sub>  | Short Circuit Output Current                                    | V <sub>CC</sub> = Max (Note 2)   | -20                   |                 | -100 | mA    |    |
| I <sub>CC</sub>  | Supply Current  | V <sub>CC</sub> = Max (Note 3)   |                       | 16              | 26   | 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, and the duration should not exceed one second.

**Note 3:** Both  $\bar{G}$  inputs are at 2V.

**Note 4:** Both  $\bar{G}$  inputs are at 0.4V.

## 'LS465 and 'LS467 Switching Characteristics

$V_{CC} = 5V$ ,  $T_A = 25^\circ C$

| Symbol    | Parameter  | $R_L = 667\Omega$    |     |                       |     | Units |
|-----------|--|----------------------|-----|-----------------------|-----|-------|
|           |  | $C_L = 50\text{ pF}$ |     | $C_L = 150\text{ pF}$ |     |       |
|           |  | Min                  | Max | Min                   | Max |       |
| $t_{PLH}$ | Propagation Delay Time<br>Low to High Level Output     |                      | 16  |                       | 25  | ns    |
| $t_{PHL}$ | Propagation Delay Time<br>High to Low Level Output     |                      | 28  |                       | 40  | ns    |
| $t_{PZH}$ | Output Enable Time<br>to High Level Output             |                      | 25  |                       | 30  | ns    |
| $t_{PZL}$ | Output Enable Time<br>to Low Level Output              |                      | 30  |                       | 42  | ns    |
| $t_{PHZ}$ | Output Disable Time<br>from High Level Output (Note 1) |                      | 20  |                       |     | ns    |
| $t_{PLZ}$ | Output Disable Time<br>from Low Level Output (Note 1)  |                      | 27  |                       |     | ns    |

Note 1:  $C_L = 5\text{ pF}$ .

## 'LS466 ('LS96A) and 'LS468 ('LS98A) Electrical Characteristics

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

| Symbol    | Parameter   | Conditions   | Min          | Typ<br>(Note 2) | Max  | Units   |         |
|-----------|---|--|--------------|-----------------|------|---------|---------|
| $V_I$     | Input Clamp Voltage   | $V_{CC} = \text{Min}$ , $I_I = -18\text{ mA}$  |              |                 | -1.5 | V       |         |
| $V_{OH}$  | High Level Output<br>Voltage  | $V_{CC} = \text{Min}$ , $I_{OH} = \text{Max}$<br>$V_{IL} = \text{Max}$ , $V_{IH} = \text{Min}$ | 2.7          |                 |      | V       |         |
| $V_{OL}$  | Low Level Output<br>Voltage   | $V_{CC} = \text{Min}$ , $I_{OL} = \text{Max}$<br>$V_{IL} = \text{Max}$ , $V_{IH} = \text{Min}$ |              |                 | 0.5  | V       |         |
|           |   | $I_{OL} = 12\text{ mA}$ , $V_{CC} = \text{Min}$  |              |                 | 0.4  |         |         |
| $I_I$     | Input Current @Max<br>Input Voltage                                   | $V_{CC} = \text{Max}$ , $V_I = 7V$   |              |                 | 0.1  | mA      |         |
| $I_{IH}$  | High Level Input Current  | $V_{CC} = \text{Max}$ , $V_I = 2.7V$   |              |                 | 20   | $\mu A$ |         |
| $I_{IL}$  | Low Level Input<br>Current  | $V_{CC} = \text{Max}$  | $V_I = 0.5V$ | A (Note 4)      |      | -20     | $\mu A$ |
|           |   |  | $V_I = 0.4V$ | A (Note 5)      |      | -50     |         |
|           |   |  | $\bar{G}$    |                 |      | -50     |         |
| $I_{OZH}$ | Off-State Output Current<br>with High Level Output<br>Voltage Applied | $V_{CC} = \text{Max}$ , $V_O = 2.4V$<br>$V_{IH} = \text{Min}$ , $V_{IL} = \text{Max}$          |              |                 | 20   | $\mu A$ |         |
| $I_{OZL}$ | Off-State Output Current<br>with Low Level Output<br>Voltage Applied  | $V_{CC} = \text{Max}$ , $V_O = 0.4V$<br>$V_{IH} = \text{Min}$ , $V_{IL} = \text{Max}$          |              |                 | -20  | $\mu A$ |         |
| $I_{OS}$  | Short Circuit<br>Output Current                                       | $V_{CC} = \text{Max}$<br>(Note 3)  | -20          |                 | -100 | mA      |         |
| $I_{CC}$  | Supply Current  | $V_{CC} = \text{Max}$ (Note 5)   |              | 13              | 21   | mA      |         |

Note 2: All typicals are at  $V_{CC} = 5V$ ,  $T_A = 25^\circ C$ .

Note 3: Not more than one output should be shorted at a time, and the duration should not exceed one second.

Note 4: Both  $\bar{G}$  inputs are at 2V.

Note 5: Both  $\bar{G}$  inputs are at 0.4V.

## 'LS466 and 'LS468 Switching Characteristics

for test waveforms and output load.  $V_{CC} = 5V$ ,  $T_A = 25^\circ C$

| Symbol    | Parameter  | $R_L = 667\Omega$    |     |                       |     | Units |
|-----------|--|----------------------|-----|-----------------------|-----|-------|
|           |  | $C_L = 50\text{ pF}$ |     | $C_L = 150\text{ pF}$ |     |       |
|           |  | Min                  | Max | Min                   | Max |       |
| $t_{PLH}$ | Propagation Delay Time<br>Low to High Level Output     |                      | 10  |                       | 16  | ns    |
| $t_{PHL}$ | Propagation Delay Time<br>High to Low Level Output     |                      | 17  |                       | 30  | ns    |
| $t_{PZH}$ | Output Enable Time<br>to High Level Output             |                      | 15  |                       | 30  | ns    |
| $t_{PZL}$ | Output Enable Time<br>to Low Level Output              |                      | 35  |                       | 45  | ns    |
| $t_{PHZ}$ | Output Disable Time<br>from High Level Output (Note 1) |                      | 20  |                       |     | ns    |
| $t_{PLZ}$ | Output Disable Time<br>from Low Level Output (Note 1)  |                      | 27  |                       |     | ns    |

Note 1:  $C_L = 5\text{ pF}$ .

### Function Tables

LS465 (LS95A)

| Inputs          |                 |   | Output<br>Y |
|-----------------|-----------------|---|-------------|
| $\overline{G}1$ | $\overline{G}2$ | A |             |
| H               | X               | X | Hi-Z        |
| X               | H               | X | Hi-Z        |
| L               | L               | H | H           |
| L               | L               | L | L           |

LS466 (LS96A)

| Inputs          |                 |   | Output<br>Y |
|-----------------|-----------------|---|-------------|
| $\overline{G}1$ | $\overline{G}2$ | A |             |
| H               | X               | X | Hi-Z        |
| X               | H               | X | Hi-Z        |
| L               | L               | H | L           |
| L               | L               | L | H           |

LS467 (LS97A)

| Inputs         |   | Output<br>Y |
|----------------|---|-------------|
| $\overline{G}$ | A |             |
| H              | X | Hi-Z        |
| L              | H | H           |
| L              | L | L           |

LS468 (LS98A)

| Inputs         |   | Output<br>Y |
|----------------|---|-------------|
| $\overline{G}$ | A |             |
| H              | X | Hi-Z        |
| L              | H | L           |
| L              | L | H           |

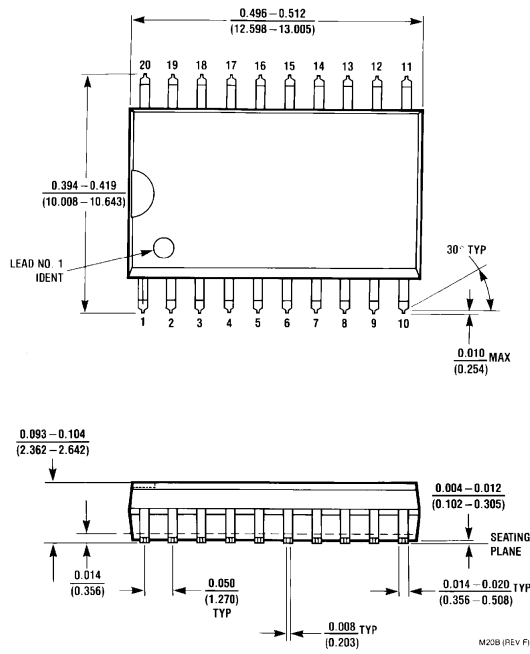
H = High Logic Level

L = Low Logic Level

X = Either High or Low Logic Level

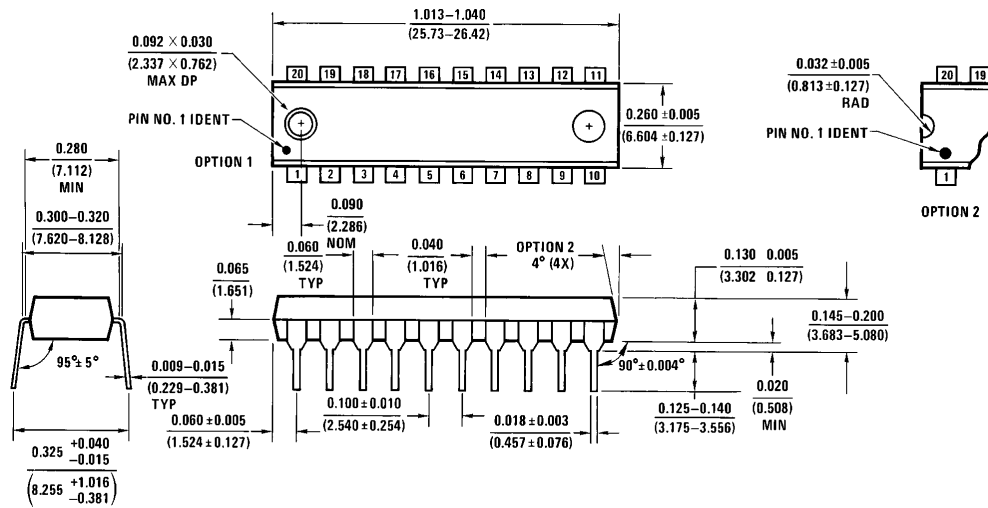
Hi-Z = High Impedance (Off) State

**Physical Dimensions** inches (millimeters)



**20-Lead Wide Small Outline Molded Package (M)**  
**Order Numbers DM74LS465WM/DM81LS95AWM, DM74LS466WM/DM81LS96AWM,**  
**DM74LS467WM/DM81LS97AWM or DM74LS468WM/DM81LS98AWM**  
**NS Package Number M20B**

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



N20A (REV G)

**20-Lead Molded Dual-In-Line Package (N)**  
**Order Numbers DM74LS465N/DM81LS95AN, DM74LS466N/DM81LS96AN,**  
**DM74LS467N/DM81LS97AN or DM74LS468N/DM81LS98AN**  
**NS Package Number N20A**

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