National Semiconductor

# DM54S240/DM74S240, DM54S241/DM74S241, DM54S244/DM74S244 Octal TRI-STATE® Buffers/Line Drivers/Line Receivers

## General Description

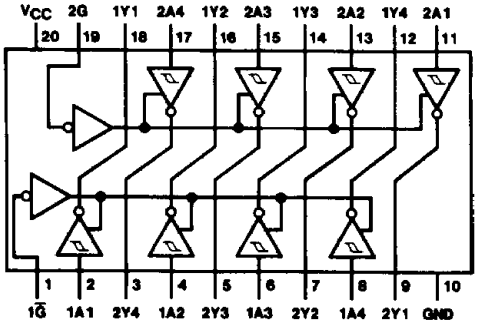
These buffers/line drivers are designed to improve both the performance and PC board density of TRI-STATE buffers/drivers employed as memory-address drivers, clock drivers, and bus-oriented transmitters/receivers. Featuring 400 mV of hysteresis at each low current PNP data line input, they provide improved noise rejection and high fanout outputs, and can be used to drive terminated lines down to 133Ω.

## Features

- TRI-STATE outputs drive bus lines directly
- PNP inputs reduce DC loading on bus lines
- Hysteresis at data inputs improves noise margins
- Typical $I_{OL}$ (sink current)
  54S 48 mA
  74S 64 mA
- Typical $I_{OH}$ (source current)
  54S −12 mA
  74S −15 mA
- Typical propagation delay times
  Inverting 4.5 ns
  Noninverting 6 ns
- Typical enable/disable times 9 ns
- Typical power dissipation (enabled)
  Inverting 450 mW
  Noninverting 538 mW

## Connection Diagrams

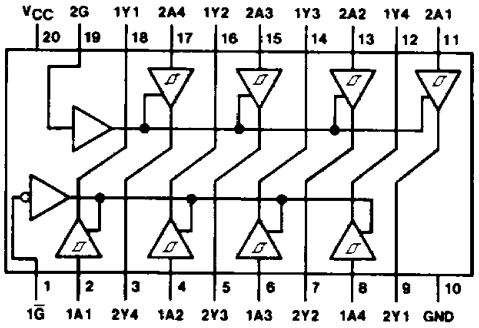
**Dual-In-Line Package**




TL/F/6478–1

**Order Number DM54S240J, DM74S240WM or DM74S240N**
**See NS Package Number J20A, M20B or N20A**

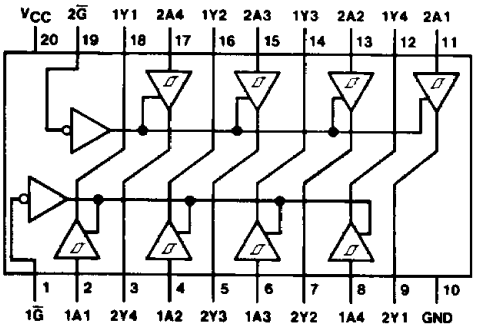
**Dual-In-Line Package**




TL/F/6478–2

**Order Number DM54S241J or DM74S241N**
**See NS Package Number J20A or N20A**

**Dual-In-Line Package**




TL/F/6478–3

**Order Number DM54S244J, DM74S244WM or DM74S244N**
**See NS Package Number J20A, M20B or N20A**

## 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 | |
| DM54S | −55°C to +125°C |
| DM74S | 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 | DM54S | | | DM74S | | | Units |
|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | |
| $V_{CC}$ | Supply Voltage | 4.5 | 5 | 5.5 | 4.75 | 5 | 5.5 | V |
| $V_{IH}$ | High Level Input Voltage | 2 | | | 2 | | | V |
| $V_{IL}$ | Low Level Input Voltage | | | 0.8 | | | 0.8 | V |
| $I_{OH}$ | High Level Output Current | | | −12 | | | −15 | mA |
| $I_{OL}$ | Low Level Output Current | | | 48 | | | 64 | mA |
| $T_A$ | Free Air Operating Temperature | −55 | | 125 | 0 | | 70 | °C |

## Electrical Characteristics over recommended operating free-air temperature range (unless otherwise noted)

| Symbol | Parameter | Conditions | | | Min | Typ (Note 1) | Max | Units |
|---|---|---|---|---|---|---|---|---|
| $V_I$ | Input Clamp Voltage | $V_{CC}$ = Min, $I_I$ = −18 mA | | | | | −1.2 | V |
| $H_{ys}$ | Hysteresis ($V_{T+} - V_{T-}$) (Data Inputs Only) | $V_{CC}$ = Min | | | 0.2 | 0.4 | | V |
| $V_{OH}$ | High Level Output Voltage | $V_{CC}$ = 4.75V, $V_{IH}$ = 2V<br>$V_{IL}$ = 0.8V, $I_{OH}$ = −1 mA | | DM74 | 2.7 | | | V |
| | | $V_{CC}$ = Min, $V_{IH}$ = 2V<br>$V_{IL}$ = 0.8V, $I_{OH}$ = −3 mA | | | 2.4 | 3.4 | | V |
| | | $V_{CC}$ = Min, $V_{IH}$ = 2V<br>$V_{IL}$ = 0.5V, $I_{OH}$ = Max | | | 2 | | | V |
| $V_{OL}$ | Low Level Output Voltage | $V_{CC}$ = Min $I_{OL}$ = Max<br>$V_{IL}$ = 0.8V, $V_{IH}$ = 2V | | DM54 | | | 0.55 | V |
| | | | | DM74 | | | 0.55 | V |
| $I_{OZH}$ | Off-State Output Current, High Level Voltage Applied | $V_{CC}$ = Max<br>$V_{IL}$ = 0.8V<br>$V_{IH}$ = 2V | $V_O$ = 2.4V | | | | 50 | μA |
| $I_{OZL}$ | Off-State Output Current, Low Level Voltage Applied | | $V_O$ = 0.5V | | | | −50 | μA |
| $I_I$ | Input Current at Maximum Input Voltage | $V_{CC}$ = Max | $V_I$ = 5.5V | | | | 1 | mA |
| $I_{IH}$ | High Level Input Current | $V_{CC}$ = Max | $V_I$ = 2.7V | | | | 50 | μA |
| $I_{IL}$ | Low Level Input Current | $V_{CC}$ = Max | $V_I$ = 0.5V | Any A | | | −400 | μA |
| | | | | Any G | | | −2 | mA |

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## Electrical Characteristics

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

| Symbol | Parameter | Conditions | | Min | Typ (Note 1) | Max | Units |
|---|---|---|---|---|---|---|---|
| $I_{OS}$ | Short Circuit Output Current | $V_{CC}$ = Max (Note 2) | | −50 | | −225 | mA |
| $I_{CC}$ | Supply Current | Outputs High | DM54S240 | | 80 | 123 | mA |
| | | | DM74S240 | | 80 | 135 | |
| | | | DM54S241, 244 | | 95 | 147 | |
| | | | DM74S241, 244 | | 95 | 160 | |
| | | Outputs Low | DM54S240 | | 100 | 145 | |
| | | | DM74S240 | | 100 | 150 | |
| | | | DM54S241, 244 | | 120 | 170 | |
| | | | DM74S241, 244 | | 120 | 180 | |
| | | Outputs Disabled | DM54S240 | | 100 | 145 | |
| | | | DM74S240 | | 100 | 150 | |
| | | | DM54S241, 244 | | 120 | 170 | |
| | | | DM74S241, 244 | | 120 | 180 | |

**Note 1:** All typical values are at $V_{CC}$ = 5V, $T_A$ = 25°C.

**Note 2:** Not more than one output should be shorted at a time and duration should not exceed one second.

## Switching Characteristics $V_{CC}$ = 5V, $T_A$ = 25°C (See Section 1 for Test Waveforms and Output Load)

| Symbol | Parameter | Conditions | | Min | Max | Units |
|---|---|---|---|---|---|---|
| $t_{PLH}$ | Propagation Delay Time Low to High Level Output | $C_L$ = 45 pF, $R_L$ = 90Ω | DM54/74S240 | 2 | 7 | ns |
| | | | DM54/74S241, 244 | 2 | 9 | |
| $t_{PHL}$ | Propagation Delay Time High to Low Level Output | $C_L$ = 45 pF, $R_L$ = 90Ω | DM54/74S240 | 2 | 7 | ns |
| | | | DM54/74S241, 244 | 2 | 9 | |
| $t_{PZL}$ | Output Enable Time to Low Level | $C_L$ = 45 pF, $R_L$ = 90Ω | DM54/74S240 | 3 | 15 | ns |
| | | | DM54/74S241, 244 | 3 | 15 | |
| $t_{PZH}$ | Output Enable Time to High Level | $C_L$ = 45 pF, $R_L$ = 90Ω | DM54/74S240 | 2 | 10 | ns |
| | | | DM54/74S241, 244 | 3 | 12 | |
| $t_{PLZ}$ | Output Disable Time from Low Level | $C_L$ = 5 pF, $R_L$ = 90Ω | DM54/74S240 | 4 | 15 | ns |
| | | | DM54/74S241, 244 | 2 | 15 | |
| $t_{PHZ}$ | Output Disable Time from High Level | $C_L$ = 5 pF, $R_L$ = 90Ω | DM54/74S240 | 2 | 9 | ns |
| | | | DM54/74S241, 244 | 2 | 9 | |
| $t_{PLH}$ | Propagation Delay Time Low to High Level Output | $C_L$ = 150 pF, $R_L$ = 90Ω | DM54/74S240 | 3 | 10 | ns |
| | | | DM54/74S241, 244 | 4 | 12 | |
| $t_{PHL}$ | Propagation Delay Time High to Low Level Output | $C_L$ = 150 pF, $R_L$ = 90Ω | DM54/74S240 | 3 | 10 | ns |
| | | | DM54/74S241, 244 | 4 | 12 | |
| $t_{PZL}$ | Output Enable Time to Low Level | $C_L$ = 150 pF, $R_L$ = 90Ω | DM54/74S240 | 6 | 21 | ns |
| | | | DM54/74S241, 244 | 6 | 21 | |
| $t_{PZH}$ | Output Enable Time to High Level | $C_L$ = 150 pF, $R_L$ = 90Ω | DM54/74S240 | 4 | 12 | ns |
| | | | DM54/74S241, 244 | 4 | 15 | |