



54LS240/DM54LS240/DM74LS240, 54LS241/DM54LS241/DM74LS241 Octal TRI-STATE® Buffers/Line Drivers/Line Receivers

General Description

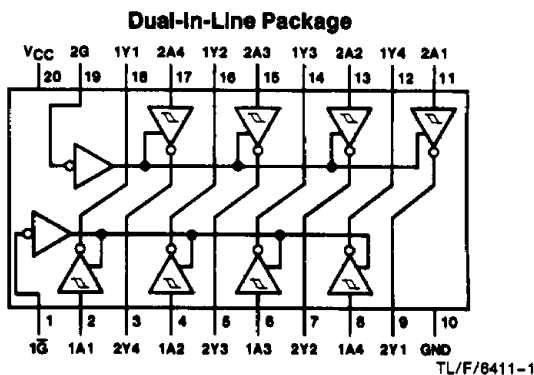
These buffers/line drivers are designed to improve both the performance and PC board density of TRI-STATE buffers/drivers employed as memory-address drivers, clock drivers, and bus-oriented transmitters/receivers. Featuring 400 mV of hysteresis at each low current PNP data line input, they provide improved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

Features

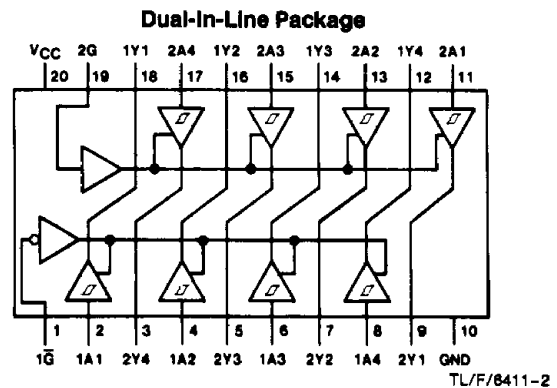
- TRI-STATE outputs drive bus lines directly
- PNP inputs reduce DC loading on bus lines
- Hysteresis at data inputs improves noise margins
- Typical I_{OL} (sink current)
 - 54LS 12 mA
 - 74LS 24 mA

- Typical I_{OH} (source current)
 - 54LS -12 mA
 - 74LS -15 mA
- Typical propagation delay times
 - Inverting 10.5 ns
 - Noninverting 12 ns
- Typical enable/disable time 18 ns
- Typical power dissipation (enabled)
 - Inverting 130 mW
 - Noninverting 135 mW
- Alternate Military/Aerospace devices (54LS240/54LS241) are available. Contact a National Semiconductor Sales Office/Distributor for specifications.

Connection Diagrams



**Order Number 54LS240DMQB, 54LS240FMQB,
54LS240LMQB, DM54LS240J,
DM74LS240WM or DM74LS240N
See NS Package Number E20A, J20A,
M20B, N20A or W20A**



**Order Number 54LS241DMQB, 54LS241FMQB,
54LS241LMQB, DM54LS241J,
DM74LS241WM or DM74LS241N
See NS Package Number E20A, J20A,
M20B, N20A or W20A**

Function Tables

LS240

| Inputs | | Output |
|-----------|---|--------|
| \bar{G} | A | Y |
| L | L | H |
| L | H | L |
| H | X | Z |

LS241

| Inputs | | | | Outputs | |
|--------|-----------|----|----|---------|----|
| G | \bar{G} | 1A | 2A | 1Y | 2Y |
| X | L | L | X | L | |
| X | L | H | X | H | |
| X | H | X | X | Z | |
| H | X | X | L | | L |
| H | X | X | H | | H |
| L | X | X | X | | Z |

L = Low Logic Level
H = High Logic Level
X = Either Low or High Logic Level
Z = High Impedance

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 | 7V |
| Operating Free Air Temperature Range | |
| DM54LS, 54LS | -55°C to +125°C |
| DM74LS | 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 | DM54LS240, 241 | | | DM74LS240, 241 | | | Units |
|-----------------|--------------------------------|----------------|-----|-----|----------------|-----|------|-------|
| | | Min | Nom | Max | Min | Nom | Max | |
| V _{CC} | Supply Voltage | 4.5 | 5 | 5.5 | 4.75 | 5 | 5.25 | V |
| V _{IH} | High Level Input Voltage | 2 | | | 2 | | | V |
| V _{IL} | Low Level Input Voltage | | | 0.7 | | | 0.8 | V |
| I _{OH} | High Level Output Current | | | -12 | | | -15 | mA |
| I _{OL} | Low Level Output Current | | | 12 | | | 24 | 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 | | | -1.5 | V | |
| HYS | Hysteresis (V _{T+} - V _{T-}) Data Inputs Only | V _{CC} = Min | 0.2 | 0.4 | | V | |
| V _{OH} | High Level Output Voltage | V _{CC} = Min, V _{IH} = Min V _{IL} = Max, I _{OH} = -1 mA | DM74 | 2.7 | | V | |
| | | V _{CC} = Min, V _{IH} = Min V _{IL} = Max, I _{OH} = -3 mA | DM54/DM74 | 2.4 | 3.4 | | |
| | | V _{CC} = Min, V _{IH} = Min V _{IL} = 0.5V, I _{OH} = Max | DM54/DM74 | 2 | | | |
| V _{OL} | Low Level Output Voltage | V _{CC} = Min V _{IL} = Max V _{IH} = Min | I _{OL} = 12 mA | DM74 | | 0.4 | V |
| | | | I _{OL} = Max | DM54 | | 0.4 | |
| | | | DM74 | | 0.5 | | |
| I _{OZH} | Off-State Output Current, High Level Voltage Applied | V _{CC} = Max V _{IL} = Max V _{IH} = Min | V _O = 2.7V | | | 20 | μA |
| I _{OZL} | Off-State Output Current, Low Level Voltage Applied | | V _O = 0.4V | | | -20 | μA |
| I _I | Input Current at Maximum Input Voltage | V _{CC} = Max, V _I = 7V (DM74) V _I = 10V (DM54) | | | | 0.1 | mA |
| I _{IH} | High Level Input Current | V _{CC} = Max, V _I = 2.7V | | | | 20 | μA |
| I _{IL} | Low Level Input Current | V _{CC} = Max, V _I = 0.4V | | | | -0.2 | mA |
| I _{OS} | Short Circuit Output Current | V _{CC} = Max (Note 2) | -40 | | | -225 | mA |
| I _{CC} | Supply Current | V _{CC} = Max, Outputs Open | Outputs High | LS240, LS241 | 13 | 23 | mA |
| | | | Outputs Low | LS240 | 26 | 44 | |
| | | | | LS241 | 27 | 46 | |
| | | | Outputs Disabled | LS240 | 29 | 50 | |
| | | | | LS241 | 32 | 54 | |

Note 1: All typicals are at V_{CC} = 5V, T_A = 25°C.

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

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

| Symbol | Parameter | Conditions | | DM54LS | DM74LS | Units |
|------------------|--|--|-------|--------|--------|-------|
| | | | | Max | Max | |
| t _{PLH} | Propagation Delay Time Low to High Level Output | C _L = 45 pF R _L = 667Ω | LS240 | 18 | 14 | ns |
| | | | LS241 | 18 | 18 | |
| t _{PHL} | Propagation Delay Time High to Low Level Output | C _L = 45 pF R _L = 667Ω | LS240 | 18 | 18 | ns |
| | | | LS241 | 18 | 18 | |
| t _{PZL} | Output Enable Time to Low Level | C _L = 45 pF R _L = 667Ω | LS240 | 30 | 30 | ns |
| | | | LS241 | 30 | 30 | |
| t _{PZH} | Output Enable Time to High Level | C _L = 45 pF R _L = 667Ω | LS240 | 23 | 23 | ns |
| | | | LS241 | 23 | 23 | |
| t _{PLZ} | Output Disable Time from Low Level | C _L = 5 pF R _L = 667Ω | LS240 | 25 | 25 | ns |
| | | | LS241 | 25 | 25 | |
| t _{PHZ} | Output Disable Time from High Level | C _L = 5 pF R _L = 667Ω | LS240 | 18 | 18 | ns |
| | | | LS241 | 18 | 18 | |
| t _{PLH} | Propagation Delay Time Low to High Level Output | C _L = 150 pF R _L = 667Ω | LS240 | | 18 | ns |
| | | | LS241 | | 21 | |
| t _{PHL} | Propagation Delay Time High to Low Level Output | C _L = 150 pF R _L = 667Ω | LS240 | | 22 | ns |
| | | | LS241 | | 22 | |
| t _{PZL} | Output Enable Time to Low Level | C _L = 150 pF R _L = 667Ω | LS240 | | 33 | ns |
| | | | LS241 | | 33 | |
| t _{PZH} | Output Enable Time to High Level | C _L = 150 pF R _L = 667Ω | LS240 | | 26 | ns |
| | | | LS241 | | 26 | |

Note: 54LS Output load is C_L = 50 pF for t_{PLH}, t_{PHL}, t_{PZL} and t_{PZH}.