

## 54LS245/DM54LS245/DM74LS245 TRI-STATE® Octal Bus Transceiver

### General Description

These octal bus transceivers are designed for asynchronous two-way communication between data buses. The control function implementation minimizes external timing requirements.

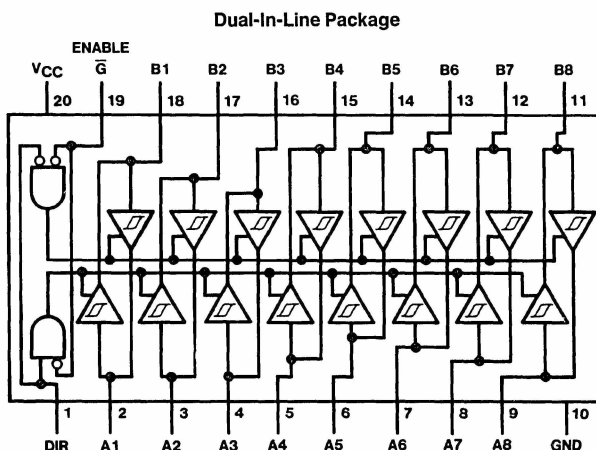
The device allows data transmission from the A bus to the B bus or from the B bus to the A bus depending upon the logic level at the direction control (DIR) input. The enable input ( $\bar{G}$ ) can be used to disable the device so that the buses are effectively isolated.

### Features

- Bi-Directional bus transceiver in a high-density 20-pin package
- TRI-STATE outputs drive bus lines directly

- PNP inputs reduce DC loading on bus lines
- Hysteresis at bus inputs improve noise margins
- Typical propagation delay times, port-to-port 8 ns
- Typical enable/disable times 17 ns
- $I_{OL}$  (sink current)
  - 54LS 12 mA
  - 74LS 24 mA
- $I_{OH}$  (source current)
  - 54LS -12 mA
  - 74LS -15 mA
- Alternate Military/Aerospace device (54LS245) is available. Contact a National Semiconductor Sales Office/Distributor for specifications.

### Connection Diagram



TL/F/6413-1

Order Number 54LS245DMQB, 54LS245FMQB, 54LS245LMQB,  
DM54LS245J, DM54LS245W, DM74LS245WM or DM74LS245N  
See NS Package Number E20A, J20A, M20B, N20A or W20A

### Function Table

| Enable<br>$\bar{G}$ | Direction<br>Control<br>DIR | Operation       |
|---------------------|-----------------------------|-----------------|
| L                   | L                           | B data to A bus |
| L                   | H                           | A data to B bus |
| H                   | X                           | Isolation       |

H = High Level, L = Low Level, X = Indeterminate

## 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    |      |
| DIR or $\bar{G}$ | 7V   |
| A or B           | 5.5V |

Operating Free Air Temperature Range  
DM54LS and 54LS  $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$   
DM74LS  $0^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$

Storage Temperature Range  $-65^{\circ}\text{C}$  to  $+150^{\circ}\text{C}$

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                      | DM54LS245 |     |     | DM74LS245 |     |      | 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   | $^{\circ}\text{C}$ |

## 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                                  | $V_{CC} = \text{Min}, I_I = -18 \text{ mA}$                                                 |                                  |              |                 | -1.5 | V             |
| HYS       | Hysteresis ( $V_{T+} - V_{T-}$ )                     | $V_{CC} = \text{Min}$                                                                       |                                  | 0.2          | 0.4             |      | V             |
| $V_{OH}$  | High Level Output Voltage                            | $V_{CC} = \text{Min}, V_{IH} = \text{Min}$<br>$V_{IL} = \text{Max}, I_{OH} = -1 \text{ mA}$ | DM74                             | 2.7          |                 |      | V             |
|           |                                                      | $V_{CC} = \text{Min}, V_{IL} = \text{Min}$<br>$V_{IL} = \text{Max}, I_{OH} = -3 \text{ mA}$ | DM54/DM74                        | 2.4          | 3.4             |      |               |
|           |                                                      | $V_{CC} = \text{Min}, V_{IH} = \text{Min}$<br>$V_{IL} = 0.5V, I_{OH} = \text{Max}$          | DM54/DM74                        | 2            |                 |      |               |
| $V_{OL}$  | Low Level Output Voltage                             | $V_{CC} = \text{Min}$<br>$V_{IL} = \text{Max}$<br>$V_{IH} = \text{Min}$                     | $I_{OL} = 12 \text{ mA}$<br>DM74 |              |                 | 0.4  | V             |
|           |                                                      |                                                                                             | $I_{OL} = \text{Max}$<br>DM54    |              |                 | 0.4  |               |
|           |                                                      |                                                                                             | DM74                             |              |                 | 0.5  |               |
| $I_{OZH}$ | Off-State Output Current, High Level Voltage Applied | $V_{CC} = \text{Max}$<br>$V_{IL} = \text{Max}$<br>$V_{IH} = \text{Min}$                     | $V_O = 2.7V$                     |              |                 | 20   | $\mu\text{A}$ |
| $I_{OZL}$ | Off-State Output Current, Low Level Voltage Applied  |                                                                                             | $V_O = 0.4V$                     |              |                 | -200 | $\mu\text{A}$ |
| $I_I$     | Input Current at Maximum Input Voltage               | $V_{CC} = \text{Max}$                                                                       | A or B                           | $V_I = 5.5V$ |                 | 0.1  | mA            |
|           |                                                      |                                                                                             | DIR or $\bar{G}$                 | $V_I = 7V$   |                 | 0.1  |               |
| $I_{IH}$  | High Level Input Current                             | $V_{CC} = \text{Max}, V_I = 2.7V$                                                           |                                  |              |                 | 20   | $\mu\text{A}$ |
| $I_{IL}$  | Low Level Input Current                              | $V_{CC} = \text{Max}, V_I = 0.4V$                                                           |                                  |              |                 | -0.2 | mA            |
| $I_{OS}$  | Short Circuit Output Current                         | $V_{CC} = \text{Max}$ (Note 2)                                                              |                                  | -40          |                 | -225 | mA            |
| $I_{CC}$  | Supply Current                                       | Outputs High                                                                                | $V_{CC} = \text{Max}$            |              | 48              | 70   | mA            |
|           |                                                      | Outputs Low                                                                                 |                                  |              | 62              | 90   |               |
|           |                                                      | Outputs at Hi-Z                                                                             |                                  |              | 64              | 95   |               |

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

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

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

| Symbol           | Parameter                                        | Conditions                                       | DM54/74 |     | Units |
|------------------|--------------------------------------------------|--------------------------------------------------|---------|-----|-------|
|                  |                                                  |                                                  | LS245   |     |       |
|                  |                                                  |                                                  | Min     | Max |       |
| t <sub>PLH</sub> | Propagation Delay Time, Low-to-High-Level Output | C <sub>L</sub> = 45 pF<br>R <sub>L</sub> = 667Ω  |         | 12  | ns    |
| t <sub>PHL</sub> | Propagation Delay Time, High-to-Low-Level Output |                                                  |         | 12  | ns    |
| t <sub>PZL</sub> | Output Enable Time to Low Level                  |                                                  |         | 40  | ns    |
| t <sub>PZH</sub> | Output Enable Time to High Level                 |                                                  |         | 40  | ns    |
| t <sub>PLZ</sub> | Output Disable Time from Low Level               | C <sub>L</sub> = 5 pF<br>R <sub>L</sub> = 667Ω   |         | 25  | ns    |
| t <sub>PHZ</sub> | Output Disable Time from High Level              |                                                  |         | 25  | ns    |
| t <sub>PLH</sub> | Propagation Delay Time, Low-to-High-Level Output | C <sub>L</sub> = 150 pF<br>R <sub>L</sub> = 667Ω |         | 16  | ns    |
| t <sub>PHL</sub> | Propagation Delay Time, High-to-Low-Level Output |                                                  |         | 17  | ns    |
| t <sub>PZL</sub> | Output Enable Time to Low Level                  |                                                  |         | 45  | ns    |
| t <sub>PZH</sub> | Output Enable Time to High Level                 |                                                  |         | 45  | ns    |