



# DM54S257/DM74S257, DM54S258/DM74S258

## TRI-STATE® Quad 1 of 2 Data Selectors/Multiplexers

### General Description

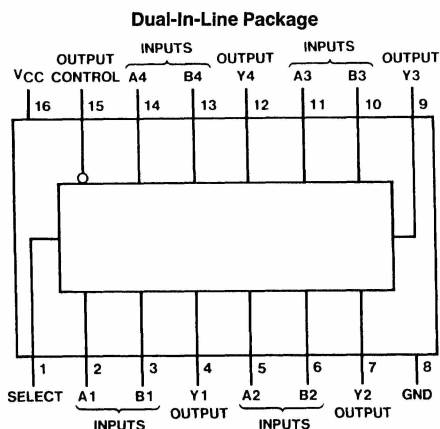
These Schottky-clamped high-performance multiplexers feature TRI-STATE outputs that can interface directly with data lines of bus-organized systems. With all but one of the common outputs disabled (at a high impedance state), the low impedance of the single enabled output will drive the bus line to a high or low logic level. To minimize the possibility that two outputs will attempt to take a common bus to opposite logic levels, the output enable circuitry is designed such that the output disable times are shorter than the output enable times.

This TRI-STATE output feature means that n-bit (paralleled) data selectors with up to 258 sources can be implemented for data buses. It also permits the use of standard TTL registers for data retention throughout the system.

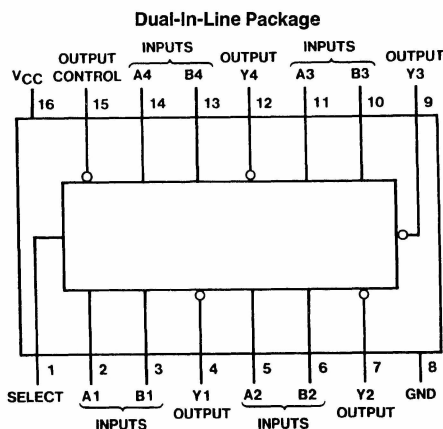
### Features

- TRI-STATE versions S157, S158, with same pin-outs
- Schottky-clamped for significant improvement in A-C performance
- Provides bus interface from multiple sources in high-performance systems
- Average propagation delay from data input
  - S257 4.8 ns
  - S258 4 ns
- Typical power dissipation
  - S257 320 mW
  - S258 280 mW

### Connection Diagrams



TL/F/6482-1



TL/F/6482-2

Order Number DM54S257J, DM54S258J, DM54S257W, DM74S257N or DM74S258N  
See NS Package Number J16A, N16E or W16A

### Function Table

| Inputs         |        |   |   | Output Y |      |
|----------------|--------|---|---|----------|------|
| Output Control | Select | A | B | S257     | S258 |
| H              | X      | X | X | Z        | Z    |
| L              | L      | L | X | L        | H    |
| L              | L      | H | X | H        | L    |
| L              | H      | X | L | L        | H    |
| L              | H      | X | H | H        | L    |

H = High Level, L = Low Level, X = Don't Care  
Z = High Impedance (off)

## 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                      | DM54S257 |     |     | DM74S257 |     |      | 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      |          |     | −2  |          |     | −6.5 | mA    |
| I <sub>OL</sub> | Low Level Output Current       |          |     | 20  |          |     | 20   | mA    |
| T <sub>A</sub>  | Free Air Operating Temperature | −55      |     | 125 | 0        |     | 70   | °C    |

## 'S257 Electrical Characteristics

over recommended operating free air temperature (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                                               |        |                 | −1.2 | V     |
| V <sub>OH</sub>  | High Level Output Voltage                                       | V <sub>CC</sub> = Min, I <sub>OH</sub> = Max                                                 | DM54   | 2.4             | 3.4  | V     |
|                  |                                                                 | V <sub>IL</sub> = Max, V <sub>IH</sub> = Min                                                 | DM74   | 2.4             | 3.2  |       |
| 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 |        |                 | 0.5  | 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<br>V <sub>I</sub> = 2.7V                                               | Select |                 | 100  | μA    |
|                  |                                                                 |                                                                                              | Other  |                 | 50   |       |
| I <sub>IL</sub>  | Low Level Input Current                                         | V <sub>CC</sub> = Max,<br>V <sub>I</sub> = 0.5V                                              | Select |                 | −4   | mA    |
|                  |                                                                 |                                                                                              | Other  |                 | −2   |       |
| 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 |        |                 | 50   | μA    |
| I <sub>OZL</sub> | Off-State Output Current with Low Level Output Voltage Applied  | V <sub>CC</sub> = Max, V <sub>O</sub> = 0.5V<br>V <sub>IH</sub> = Min, V <sub>IL</sub> = Max |        |                 | −50  | μA    |
| I <sub>OS</sub>  | Short Circuit Output Current                                    | V <sub>CC</sub> = Max<br>(Note 2)                                                            | DM54   | −40             | −100 | mA    |
|                  |                                                                 |                                                                                              | DM74   | −40             | −100 |       |
| I <sub>CCH</sub> | Supply Current with Outputs High                                | V <sub>CC</sub> = Max (Note 3)                                                               |        | 44              | 68   | mA    |
| I <sub>CCL</sub> | Supply Current with Outputs Low                                 | V <sub>CC</sub> = Max (Note 3)                                                               |        | 60              | 93   | mA    |
| I <sub>CCZ</sub> | Supply Current with Outputs Disabled                            | V <sub>CC</sub> = Max (Note 3)                                                               |        | 64              | 99   | 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: I<sub>CC</sub> is measured with all outputs open and all possible inputs grounded, while achieving the stated output conditions.

**'S257 Switching Characteristics**at  $V_{CC} = 5V$  and  $T_A = 25^\circ C$  (See Section 1 for Test Waveforms and Output Load)

| Symbol           | Parameter                                            | From (Input)<br>To (Output) | R <sub>L</sub> = 280Ω  |      |                        |     | Units |
|------------------|------------------------------------------------------|-----------------------------|------------------------|------|------------------------|-----|-------|
|                  |                                                      |                             | C <sub>L</sub> = 15 pF |      | C <sub>L</sub> = 50 pF |     |       |
|                  |                                                      |                             | Min                    | Max  | Min                    | Max |       |
| t <sub>PLH</sub> | Propagation Delay Time<br>Low to High Level Output   | Data to<br>Output           |                        | 7.5  |                        | 11  | ns    |
| t <sub>PHL</sub> | Propagation Delay Time<br>High to Low Level Output   | Data to<br>Output           |                        | 6.5  |                        | 10  | ns    |
| t <sub>PLH</sub> | Propagation Delay Time<br>Low to High Level Output   | Select to<br>Output         |                        | 15   |                        | 16  | ns    |
| t <sub>PHL</sub> | Propagation Delay Time<br>High to Low Level Output   | Select to<br>Output         |                        | 15   |                        | 16  | ns    |
| t <sub>PZH</sub> | Output Enable Time<br>to High Level Output           | Output<br>Control to Y      |                        | 19.5 |                        | 23  | ns    |
| t <sub>PZL</sub> | Output Enable Time<br>to Low Level Output            | Output<br>Control to Y      |                        | 21   |                        | 24  | ns    |
| t <sub>PHZ</sub> | Output Disable Time<br>to High Level Output (Note 1) | Output<br>Control to Y      |                        | 8.5  |                        |     | ns    |
| t <sub>PLZ</sub> | Output Disable Time<br>to Low Level Output (Note 1)  | Output<br>Control to Y      |                        | 14   |                        |     | ns    |

Note 1:  $C_L = 5\text{ pF}$ .**Recommended Operating Conditions**

| Symbol   | Parameter                      | DM54S258 |     |     | DM74S258 |     |      | 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        |          |     | 0.8 |          |     | 0.8  | V          |
| $I_{OH}$ | High Level Output Current      |          |     | -2  |          |     | -6.5 | mA         |
| $I_{OL}$ | Low Level Output Current       |          |     | 20  |          |     | 20   | mA         |
| $T_A$    | Free Air Operating Temperature | -55      |     | 125 | 0        |     | 70   | $^\circ C$ |

**'S258 Electrical Characteristics**

over recommended operating free air temperature (unless otherwise noted)

| Symbol   | Parameter                            | Conditions                                                                               | Min    | Typ<br>(Note 1) | Max  | Units   |
|----------|--------------------------------------|------------------------------------------------------------------------------------------|--------|-----------------|------|---------|
| $V_I$    | Input Clamp Voltage                  | $V_{CC} = \text{Min}, I_I = -18\text{ mA}$                                               |        |                 | -1.2 | V       |
| $V_{OH}$ | High Level Output<br>Voltage         | $V_{CC} = \text{Min}, I_{OH} = \text{Max}$<br>$V_{IL} = \text{Max}, V_{IH} = \text{Min}$ | DM54   | 2.4             | 3.4  | V       |
|          |                                      |                                                                                          | DM74   | 2.4             | 3.2  |         |
| $V_{OL}$ | Low Level Output<br>Voltage          | $V_{CC} = \text{Min}, I_{OL} = \text{Max}$<br>$V_{IH} = \text{Min}, V_{IL} = \text{Max}$ |        |                 | 0.5  | V       |
| $I_I$    | Input Current @ Max<br>Input Voltage | $V_{CC} = \text{Max}, V_I = 5.5V$                                                        |        |                 | 1    | mA      |
| $I_{IH}$ | High Level Input<br>Current          | $V_{CC} = \text{Max},$<br>$V_I = 2.7V$                                                   | Select |                 | 100  | $\mu A$ |
|          |                                      |                                                                                          | Other  |                 | 50   |         |
| $I_{IL}$ | Low Level Input<br>Current           | $V_{CC} = \text{Max},$<br>$V_I = 0.5V$                                                   | Select |                 | -4   | mA      |
|          |                                      |                                                                                          | Other  |                 | -2   |         |

**'S258 Electrical Characteristics**

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

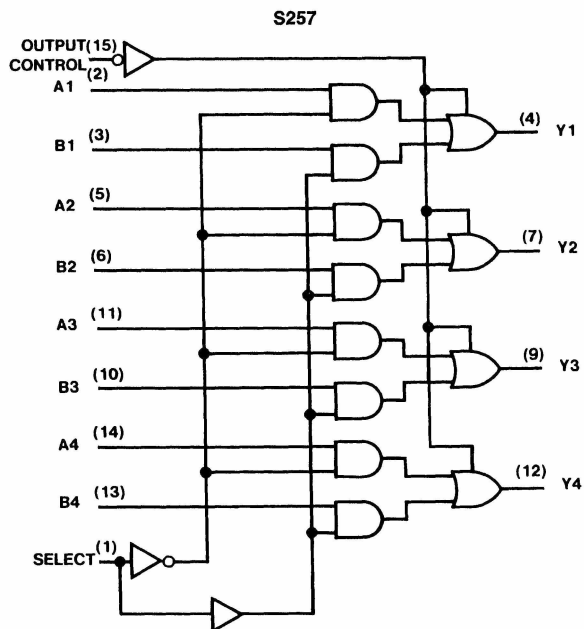
| Symbol           | Parameter                                                       | Conditions                                                                                   | Min         | Typ<br>(Note 1) | Max  | Units |
|------------------|-----------------------------------------------------------------|----------------------------------------------------------------------------------------------|-------------|-----------------|------|-------|
| 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 |             |                 | 50   | μA    |
| I <sub>OZL</sub> | Off-State Output Current with Low Level Output Voltage Applied  | V <sub>CC</sub> = Max, V <sub>O</sub> = 0.5V<br>V <sub>IH</sub> = Min, V <sub>IL</sub> = Max |             |                 | −50  | μA    |
| I <sub>OS</sub>  | Short Circuit Output Current                                    | V <sub>CC</sub> = Max<br>(Note 2)                                                            | DM54<br>−40 |                 | −100 | mA    |
|                  |                                                                 |                                                                                              | DM74<br>−40 |                 | −100 |       |
| I <sub>CCH</sub> | Supply Current with Outputs High                                | V <sub>CC</sub> = Max<br>(Note 3)                                                            |             | 36              | 56   | mA    |
| I <sub>CCL</sub> | Supply Current with Outputs Low                                 | V <sub>CC</sub> = Max<br>(Note 3)                                                            |             | 52              | 81   | mA    |
| I <sub>CCZ</sub> | Supply Current with Outputs Disabled                            | V <sub>CC</sub> = Max<br>(Note 3)                                                            |             | 56              | 87   | 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:** I<sub>CC</sub> is measured with all outputs open and all possible inputs grounded, while achieving the stated output conditions.**'S258 Switching Characteristics**at V<sub>CC</sub> = 5V and T<sub>A</sub> = 25°C (See Section 1 for Test Waveforms and Output Load)

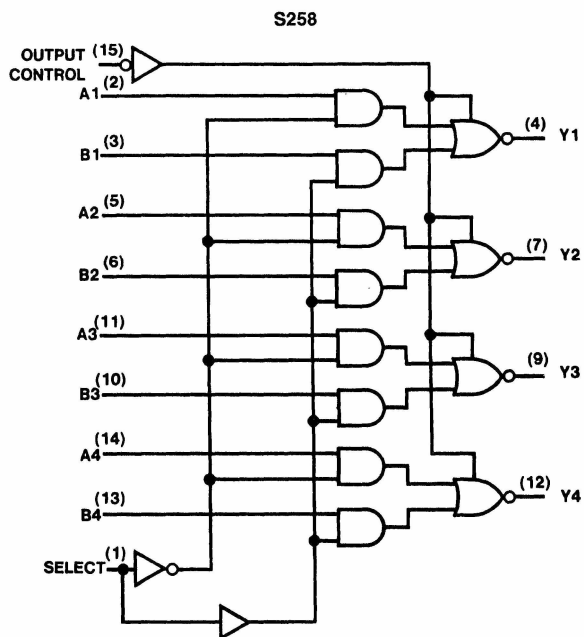
| Symbol           | Parameter                                            | From (Input)<br>To (Output) | R <sub>L</sub> = 280Ω  |      |                        |     | Units |
|------------------|------------------------------------------------------|-----------------------------|------------------------|------|------------------------|-----|-------|
|                  |                                                      |                             | C <sub>L</sub> = 15 pF |      | C <sub>L</sub> = 50 pF |     |       |
|                  |                                                      |                             | Min                    | Max  | Min                    | Max |       |
| t <sub>PLH</sub> | Propagation Delay Time<br>Low to High Level Output   | Data to<br>Output           |                        | 6    |                        | 9   | ns    |
| t <sub>PHL</sub> | Propagation Delay Time<br>High to Low Level Output   | Data to<br>Output           |                        | 6    |                        | 9   | ns    |
| t <sub>PLH</sub> | Propagation Delay Time<br>Low to High Level Output   | Select to<br>Output         |                        | 12   |                        | 15  | ns    |
| t <sub>PHL</sub> | Propagation Delay Time<br>High to Low Level Output   | Select to<br>Output         |                        | 12   |                        | 15  | ns    |
| t <sub>PZH</sub> | Output Enable Time<br>to High Level Output           | Output<br>Control to Y      |                        | 19.5 |                        | 23  | ns    |
| t <sub>PZL</sub> | Output Enable Time<br>to Low Level Output            | Output<br>Control to Y      |                        | 21   |                        | 24  | ns    |
| t <sub>PHZ</sub> | Output Disable Time<br>to High Level Output (Note 1) | Output<br>Control to Y      |                        | 8.5  |                        |     | ns    |
| t <sub>PLZ</sub> | Output Disable Time<br>to Low Level Output (Note 1)  | Output<br>Control to Y      |                        | 14   |                        |     | ns    |

**Note 1:** C<sub>L</sub> = 5 pF.

## Logic Diagrams



TL/F/6482-3



TL/F/6482-4