



## 54F/74F533

# Octal Transparent Latch with TRI-STATE® Outputs

### General Description

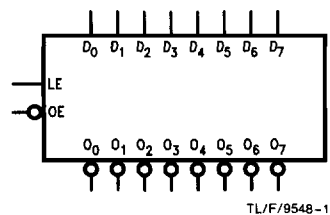
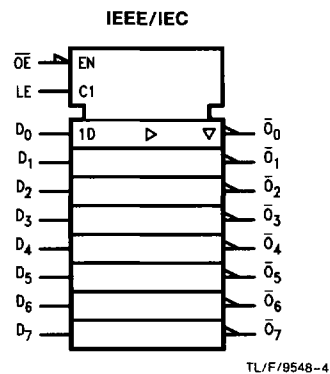
The 'F533 consists of eight latches with TRI-STATE outputs for bus organized system applications. The flip-flops appear transparent to the data when Latch Enable (LE) is HIGH. When LE is LOW, the data that meets the setup times is latched. Data appears on the bus when the Output Enable ( $\overline{OE}$ ) is LOW. When  $\overline{OE}$  is HIGH the bus output is in the high impedance state. The 'F533 is the same as the 'F373, except that the outputs are inverted.

### Features

- Eight latches in a single package
- TRI-STATE outputs for bus interfacing
- Inverted version of the 'F373

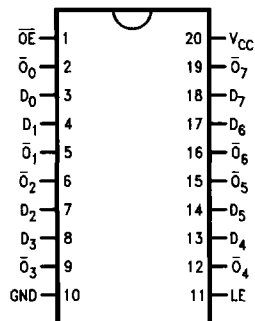
**Ordering Code:** See Section 5

### Logic Symbols

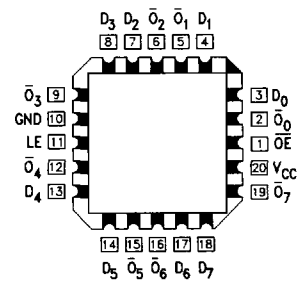


### Connection Diagrams

**Pin Assignment  
for DIP, SOIC and Flatpak**



**Pin Assignment  
for LCC and PCC**



## Unit Loading/Fan Out: See Section 2 for U.L. definitions

| Pin Names                       | Description                      | 54F/74F          |   |
|---------------------------------|----------------------------------|------------------|---|
|                                 |                                  | U.L.<br>HIGH/LOW | Input $I_{IH}/I_{IL}$<br>Output $I_{OH}/I_{OL}$ |
| $D_0-D_7$                       | Data Inputs                      | 1.0/1.0          | 20 $\mu$ A/ -0.6 mA                             |
| LE                              | Latch Enable Input (Active HIGH) | 1.0/1.0          | 20 $\mu$ A/ -0.6 mA                             |
| $\overline{OE}$                 | Output Enable Input (Active LOW) | 1.0/1.0          | 20 $\mu$ A/ -0.6 mA                             |
| $\overline{O}_0-\overline{O}_7$ | Complementary TRI-STATE Outputs  | 150/40 (33.3)    | -3 mA/24 mA (20 mA)                             |

Function Table

| Inputs |                 |   | Output           |
|--------|-----------------|---|------------------|
| LE     | $\overline{OE}$ | D | $\overline{O}$   |
| H      | L               | H | L                |
| H      | L               | L | H                |
| L      | L               | X | $\overline{O}_0$ |
| X      | H               | X | Z                |

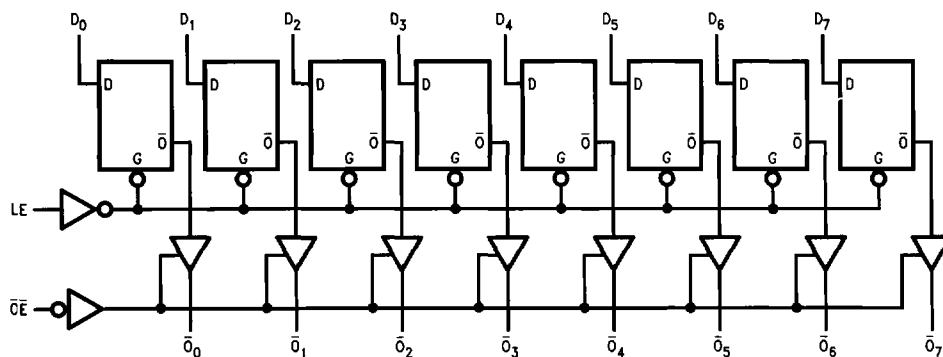
H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Immaterial

## Functional Description

The 'F533 contains eight D-type latches with TRI-STATE output buffers. When the Latch Enable (LE) input is HIGH, data on the  $D_n$  inputs enters the latches. In this condition the latches are transparent, i.e., a latch output will change state each time its D input changes. When LE is LOW, the latches store the information that was present on the D in-

puts a setup time preceding the HIGH-to-LOW transition of LE. The TRI-STATE buffers are controlled by the Output Enable ( $\overline{OE}$ ) input. When  $\overline{OE}$  is LOW, the buffers are in the bi-state mode. When  $\overline{OE}$  is HIGH the buffers are in the high impedance mode but this does not interfere with entering new data into the latches.

## Logic Diagram



TL/F/9548-5

Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

## Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, contact the National Semiconductor Sales Office/Distributors for availability and specifications.

|   |                          |
|---|--------------------------|
| Storage Temperature   | -65°C to +150°C          |
| Ambient Temperature under Bias                                      | -55°C to +125°C          |
| Junction Temperature under Bias                                     | -55°C to +175°C          |
| V <sub>CC</sub> Pin Potential to Ground Pin                         | -0.5V to +7.0V           |
| Input Voltage (Note 2)  | -0.5V to +7.0V           |
| Input Current (Note 2)  | -30 mA to +5.0 mA        |
| Voltage Applied to Output in HIGH State (with V <sub>CC</sub> = 0V) |                          |
| Standard Output   | -0.5V to V <sub>CC</sub> |
| TRI-STATE Output  | -0.5V to +5.5V           |

Current Applied to Output in LOW State (Max) twice the rated I<sub>OL</sub> (mA)

**Note 1:** Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

**Note 2:** Either voltage limit or current limit is sufficient to protect inputs.

## Recommended Operating Conditions

|                              |                 |
|------------------------------|-----------------|
| Free Air Ambient Temperature |                 |
| Military                     | -55°C to +125°C |
| Commercial                   | 0°C to +70°C    |
| Supply Voltage               |                 |
| Military                     | +4.5V to +5.5V  |
| Commercial                   | +4.5V to +5.5V  |

## DC Electrical Characteristics

| Symbol           | Parameter                         | 54F/74F  |  |            | Units | V <sub>CC</sub> | Conditions   |
|------------------|-----------------------------------|--|--|------------|-------|-----------------|--|
|                  |                                   | Min  | Typ                                    | Max        |       |                 |  |
| V <sub>IH</sub>  | Input HIGH Voltage                | 2.0  |  |            | V     |                 | Recognized as a HIGH Signal  |
| V <sub>IL</sub>  | Input LOW Voltage                 |  |  | 0.8        | V     |                 | Recognized as a LOW Signal   |
| V <sub>CD</sub>  | Input Clamp Diode Voltage         |  |  | -1.2       | V     | Min             | I <sub>IN</sub> = -18 mA   |
| V <sub>OH</sub>  | Output HIGH Voltage               | 54F 10% V <sub>CC</sub><br>54F 10% V <sub>CC</sub><br>74F 10% V <sub>CC</sub><br>74F 10% V <sub>CC</sub><br>74F 5% V <sub>CC</sub><br>74F 5% V <sub>CC</sub> | 2.5<br>2.4<br>2.5<br>2.4<br>2.7<br>2.7 |            | V     | Min             | I <sub>OH</sub> = -1 mA<br>I <sub>OH</sub> = -3 mA<br>I <sub>OH</sub> = -1 mA<br>I <sub>OH</sub> = -3 mA<br>I <sub>OH</sub> = -1 mA<br>I <sub>OH</sub> = -3 mA |
| V <sub>OL</sub>  | Output LOW Voltage                | 54F 10% V <sub>CC</sub><br>74F 10% V <sub>CC</sub>   |  | 0.5<br>0.5 | V     | Min             | I <sub>OL</sub> = 20 mA<br>I <sub>OL</sub> = 24 mA   |
| I <sub>IH</sub>  | Input HIGH Current                |  |  | 20         | μA    | Max             | V <sub>IN</sub> = 2.7V   |
| I <sub>BVI</sub> | Input HIGH Current Breakdown Test |  |  | 100        | μA    | Max             | V <sub>IN</sub> = 7.0V   |
| I <sub>IL</sub>  | Input LOW Current                 |  |  | -0.6       | mA    | Max             | V <sub>IN</sub> = 0.5V   |
| I <sub>OZH</sub> | Output Leakage Current            |  |  | 50         | μA    | Max             | V <sub>OUT</sub> = 2.7V  |
| I <sub>OZL</sub> | Output Leakage Current            |  |  | -50        | μA    | Max             | V <sub>OUT</sub> = 0.5V  |
| I <sub>OS</sub>  | Output Short-Circuit Current      | -60  |  | -150       | mA    | Max             | V <sub>OUT</sub> = 0V  |
| I <sub>CEX</sub> | Output HIGH Leakage Current       |  |  | 250        | μA    | Max             | V <sub>OUT</sub> = V <sub>CC</sub>   |
| I <sub>ZZ</sub>  | Bus Drainage Test                 |  |  | 500        | μA    | 0.0V            | V <sub>OUT</sub> = V <sub>CC</sub>   |
| I <sub>CCZ</sub> | Power Supply Current              |  | 41                                     | 61         | mA    | Max             | V <sub>O</sub> = HIGH Z  |

**AC Electrical Characteristics:** See Section 2 for Waveforms and Load Configurations

| Symbol                 | Parameter                                 | 74F  |            |             | 54F  |              | 74F  |             | Units | Fig No |
|------------------------|---|--|------------|-------------|--|--------------|--|-------------|-------|--------|
|                        |   | $T_A = +25^\circ\text{C}$<br>$V_{CC} = +5.0\text{V}$<br>$C_L = 50\text{ pF}$ |            |             | $T_A, V_{CC} = \text{Mil}$<br>$C_L = 50\text{ pF}$ |              | $T_A, V_{CC} = \text{Com}$<br>$C_L = 50\text{ pF}$ |             |       |        |
|                        |   | Min  | Typ        | Max         | Min  | Max          | Min  | Max         |       |        |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>$D_n$ to $\bar{O}_n$ | 4.0<br>2.5   | 6.7<br>4.4 | 9.0<br>7.0  | 4.0<br>2.5   | 12.0<br>9.0  | 4.0<br>2.5   | 10.0<br>8.0 | ns    | 2-3    |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>LE to $\bar{O}_n$    | 5.0<br>3.0   | 7.1<br>4.7 | 11.0<br>7.0 | 5.0<br>3.0   | 14.0<br>9.0  | 5.0<br>3.0   | 13.0<br>8.0 | ns    | 2-3    |
| $t_{pZH}$<br>$t_{pZL}$ | Output Enable Time                        | 2.0<br>2.0   | 5.9<br>5.6 | 10.0<br>7.5 | 2.0<br>2.0   | 12.5<br>10.5 | 2.0<br>2.0   | 11.0<br>8.5 | ns    | 2-5    |
| $t_{pHZ}$<br>$t_{pLZ}$ | Output Disable Time                       | 1.5<br>1.5   | 3.4<br>2.7 | 6.5<br>5.5  | 1.5<br>1.5   | 8.5<br>7.5   | 1.5<br>1.5   | 7.0<br>6.5  | ns    | 2-5    |

**AC Operating Requirements:** See Section 2 for Waveforms

| Symbol               | Parameter                              | 74F  |     | 54F                        |     | 74F                        |     | Units | Fig No |
|----------------------|--|--|-----|----------------------------|-----|----------------------------|-----|-------|--------|
|                      |  | $T_A = +25^\circ\text{C}$<br>$V_{CC} = +5.0\text{V}$ |     | $T_A, V_{CC} = \text{Mil}$ |     | $T_A, V_{CC} = \text{Com}$ |     |       |        |
|                      |  | Min  | Max | Min                        | Max | Min                        | Max |       |        |
| $t_s(H)$<br>$t_s(L)$ | Setup Time, HIGH or LOW<br>$D_n$ to LE | 2.0<br>2.0   |     | 2.0<br>2.0                 |     | 2.0<br>2.0                 |     | ns    | 2-6    |
| $t_h(H)$<br>$t_h(L)$ | Hold Time, HIGH or LOW<br>$D_n$ to LE  | 3.0<br>3.0   |     | 3.0<br>3.0                 |     | 3.0<br>3.0                 |     | ns    | 2-6    |
| $t_w(H)$             | LE Pulse Width, HIGH                   | 6.0  |     | 6.0                        |     | 6.0                        |     | ns    | 2-4    |