

## 54F/74F540 • 54F/74F541

### Octal Buffer/Line Driver with TRI-STATE® Outputs

#### General Description

The 'F540 and 'F541 are similar in function to the 'F240 and 'F244 respectively, except that the inputs and outputs are on opposite sides of the package (see Connection Diagrams). This pinout arrangement makes these devices especially useful as output ports for microprocessors, allowing ease of layout and greater PC board density.

#### Features

- TRI-STATE outputs drive bus lines
- Inputs and outputs opposite side of package, allowing easier interface to microprocessors

#### Ordering Code: See Section 11

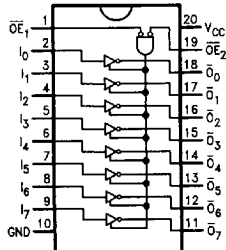
| Commercial        | Military          | Package Number | Package Description                               |
|-------------------|-------------------|----------------|---------------------------------------------------|
| 74F540PC          |                   | N20A           | 20-Lead (0.300" Wide) Molded Dual-In-Line         |
|                   | 54F540DM (Note 2) | J20A           | 20-Lead Ceramic Dual-In-Line                      |
| 74F540SC (Note 1) |                   | M20B           | 20-Lead (0.300" Wide) Molded Small Outline, JEDEC |
| 74F540SJ (Note 1) |                   | M20D           | 20-Lead (0.300" Wide) Molded Small Outline, EIAJ  |
|                   | 54F540FM (Note 2) | W20A           | 20-Lead Cerpack                                   |
|                   | 54F540LM (Note 2) | E20A           | 20-Lead Ceramic Leadless Chip Carrier, Type C     |
| 74F541PC          |                   | N20A           | 20-Lead (0.300" Wide) Molded Dual-In-Line         |
|                   | 54F541DM (Note 2) | J20A           | 20-Lead Ceramic Dual-In-Line                      |
| 74F541SC (Note 1) |                   | M20B           | 20-Lead (0.300" Wide) Molded Small Outline, JEDEC |
| 74F541SJ (Note 1) |                   | M20D           | 20-Lead (0.300" Wide) Molded Small Outline, EIAJ  |
|                   | 54F541FM (Note 2) | W20A           | 20-Lead Cerpack                                   |
|                   | 54F541LM (Note 2) | E20A           | 20-Lead Ceramic Leadless Chip Carrier, Type C     |

**Note 1:** Devices also available in 13" reel. Use suffix = SCX and SJX.

**Note 2:** Military grade device with environmental and burn-in processing. Use suffix = DMOB, FMQB and LMQB.

#### Connection Diagrams

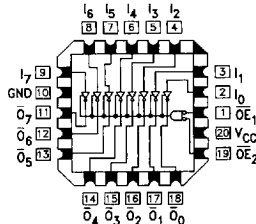
Pin Assignment for  
DIP, SOIC and Flatpak



TL/F/9553-1

'F540

Pin Assignment  
for LCC

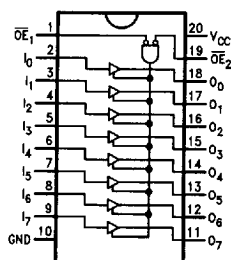


TL/F/9553-2

6501122 0J82535 496

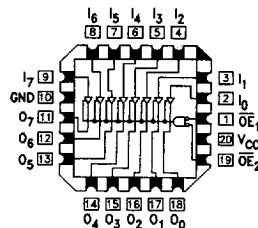
7-385

# Connection Diagrams (Continued)



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'F541



TL/F/9553-5

**Unit Loading/Fan Out:** See Section 2 for U.L. Definitions

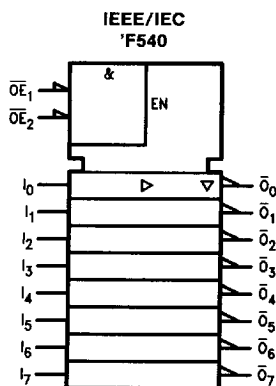
| Pin Names                          | Description                                | 54F/74F          |                                                 |
|------------------------------------|--------------------------------------------|------------------|-------------------------------------------------|
|                                    |                                            | U.L.<br>HIGH/LOW | Input $I_{IH}/I_{IL}$<br>Output $I_{OH}/I_{OL}$ |
| $\overline{OE}_1, \overline{OE}_2$ | TRI-STATE Output Enable Input (Active LOW) | 1.0/1.0          | 20 $\mu$ A/ -0.6 mA                             |
| $I_n$                              | Inputs                                     | 1.0/1.0          | 20 $\mu$ A/ -0.6 mA                             |
| $O_n, \overline{O}_n$              | Outputs                                    | 600/106.6 (80)   | -12 mA/64 mA (48 mA)                            |

## Truth Table

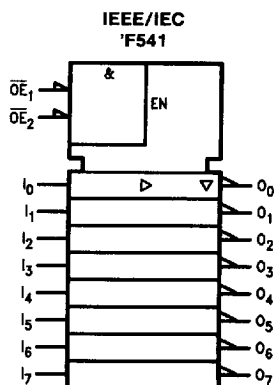
| Inputs            |                   |   | Outputs |       |
|-------------------|-------------------|---|---------|-------|
| $\overline{OE}_1$ | $\overline{OE}_2$ | I | 'F540   | 'F541 |
| L                 | L                 | H | L       | H     |
| H                 | X                 | X | Z       | Z     |
| X                 | H                 | X | Z       | Z     |
| L                 | L                 | L | H       | L     |

H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Immaterial  
Z = High Impedance

## Logic Diagrams



TL/F/9553-3



TL/F/9553-6

**Absolute Maximum Ratings** (Note 1)

If Military/Aerospace specified devices are required, please 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 |
| Plastic                         | −55°C to +150°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> | 2.4  |      | V     | Min             | I <sub>OH</sub> = −3 mA                              |
|                  |                                   | 54F 10% V <sub>CC</sub> | 2.0  |      |       |                 | I <sub>OH</sub> = −12 mA                             |
|                  |                                   | 74F 10% V <sub>CC</sub> | 2.4  |      |       |                 | I <sub>OH</sub> = −3 mA                              |
|                  |                                   | 74F 10% V <sub>CC</sub> | 2.0  |      |       |                 | I <sub>OH</sub> = −15 mA                             |
|                  |                                   | 74F 5% V <sub>CC</sub>  | 2.7  |      |       |                 | I <sub>OH</sub> = −3 mA                              |
| V <sub>OL</sub>  | Output LOW Voltage                | 54F 10% V <sub>CC</sub> |      | 0.55 | V     | Min             | I <sub>OL</sub> = 48 mA                              |
|                  |                                   | 74F 10% V <sub>CC</sub> |      | 0.55 |       |                 | I <sub>OL</sub> = 64 mA                              |
| I <sub>IH</sub>  | Input HIGH Current                | 54F                     |      | 20.0 | μA    | Max             | V <sub>IN</sub> = 2.7V                               |
|                  |                                   | 74F                     |      | 5.0  |       |                 |                                                      |
| I <sub>BVI</sub> | Input HIGH Current Breakdown Test | 54F                     |      | 100  | μA    | Max             | V <sub>IN</sub> = 7.0V                               |
|                  |                                   | 74F                     |      | 7.0  |       |                 |                                                      |
| I <sub>CEX</sub> | Output HIGH Leakage Current       | 54F                     |      | 250  | μA    | Max             | V <sub>OUT</sub> = V <sub>CC</sub>                   |
|                  |                                   | 74F                     |      | 50   |       |                 |                                                      |
| V <sub>ID</sub>  | Input Leakage Test                | 74F                     | 4.75 |      | V     | 0.0             | I <sub>ID</sub> = 1.9 μA<br>All Other Pins Grounded  |
| I <sub>OD</sub>  | Output Leakage Circuit Current    | 74F                     |      | 3.75 | μA    | 0.0             | V <sub>IOD</sub> = 150 mV<br>All Other Pins Grounded |
| 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      |                         | −100 | −225 | mA    | Max             | V <sub>OUT</sub> = 0V                                |
| I <sub>ZZ</sub>  | Bus Drainage Test                 |                         |      | 500  | μA    | 0.0V            | V <sub>OUT</sub> = 5.25V                             |

**DC Electrical Characteristics** (Continued)

| Symbol           | Parameter                    | 54F/74F |     |     | Units | V <sub>CC</sub> | Conditions              |
|------------------|------------------------------|---------|-----|-----|-------|-----------------|-------------------------|
|                  |                              | Min     | Typ | Max |       |                 |                         |
| I <sub>CCH</sub> | Power Supply Current ('F540) |         | 11  | 20  | mA    | Max             | V <sub>O</sub> = HIGH   |
| I <sub>CCL</sub> | Power Supply Current ('F540) |         | 53  | 75  | mA    | Max             | V <sub>O</sub> = LOW    |
| I <sub>CCZ</sub> | Power Supply Current ('F540) |         | 31  | 45  | mA    | Max             | V <sub>O</sub> = HIGH Z |
| I <sub>CCH</sub> | Power Supply Current ('F541) |         | 26  | 35  | mA    | Max             | V <sub>O</sub> = HIGH   |
| I <sub>CCL</sub> | Power Supply Current ('F541) |         | 55  | 75  | mA    | Max             | V <sub>O</sub> = LOW    |
| I <sub>CCZ</sub> | Power Supply Current ('F541) |         | 31  | 55  | 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 <sub>A</sub> = +25°C<br>V <sub>CC</sub> = +5.0V<br>C <sub>L</sub> = 50 pF |     |      | T <sub>A</sub> , V <sub>CC</sub> = Mil<br>C <sub>L</sub> = 50 pF |      | T <sub>A</sub> , V <sub>CC</sub> = Com<br>C <sub>L</sub> = 50 pF |      |       |          |
|                  |                             | Min                                                                         | Typ | Max  | Min                                                              | Max  | Min                                                              | Max  |       |          |
| t <sub>PLH</sub> | Propagation Delay           | 1.5                                                                         | 3.0 | 5.0  | 1.0                                                              | 6.0  | 1.0                                                              | 5.5  | ns    | 2-3      |
| t <sub>PHL</sub> | Data to Output ('F540)      | 1.0                                                                         | 2.0 | 4.0  | 1.0                                                              | 4.5  | 1.0                                                              | 4.0  |       |          |
| t <sub>PZH</sub> | Output Enable Time ('F540)  | 2.5                                                                         | 4.9 | 8.0  | 2.5                                                              | 9.0  | 2.5                                                              | 8.5  | ns    | 2-5      |
| t <sub>PZL</sub> |                             | 3.5                                                                         | 5.8 | 10.0 | 3.5                                                              | 11.0 | 3.5                                                              | 10.5 |       |          |
| t <sub>PHZ</sub> | Output Disable Time ('F540) | 1.5                                                                         | 3.4 | 6.0  | 1.5                                                              | 7.0  | 1.5                                                              | 6.5  |       |          |
| t <sub>PLZ</sub> |                             | 1.0                                                                         | 2.5 | 5.5  | 1.0                                                              | 7.5  | 1.0                                                              | 6.0  |       |          |
| t <sub>PLH</sub> | Propagation Delay           | 1.5                                                                         | 3.3 | 5.5  |                                                                  |      | 1.5                                                              | 6.0  | ns    | 2-3      |
| t <sub>PHL</sub> | Data to Output ('F541)      | 1.5                                                                         | 2.7 | 5.5  |                                                                  |      | 1.5                                                              | 6.0  |       |          |
| t <sub>PZH</sub> | Output Enable Time ('F541)  | 3.0                                                                         | 5.8 | 8.0  |                                                                  |      | 2.5                                                              | 9.5  | ns    | 2-5      |
| t <sub>PZL</sub> |                             | 3.5                                                                         | 6.1 | 8.5  |                                                                  |      | 3.0                                                              | 9.5  |       |          |
| t <sub>PHZ</sub> | Output Disable Time ('F541) | 1.5                                                                         | 3.4 | 6.0  |                                                                  |      | 1.5                                                              | 6.5  |       |          |
| t <sub>PLZ</sub> |                             | 1.5                                                                         | 2.9 | 5.5  |                                                                  |      | 1.5                                                              | 6.0  |       |          |