

## PART NUMBER

**54F350BEA-ROCV**

### Rochester Electronics

#### Manufactured Components

Rochester branded components are manufactured using either die/wafers purchased from the original suppliers or Rochester wafers recreated from the original IP. All re-creations are done with the approval of the Original Component Manufacturer. (OCM)

Parts are tested using original factory test programs or Rochester developed test solutions to guarantee product meets or exceeds the OCM data sheet.

### Quality Overview

- ISO-9001
- AS9120 certification
- Qualified Manufacturers List (QML) MIL-PRF-38535
  - Class Q Military
  - Class V Space Level

#### Qualified Suppliers List of Distributors (QSLD)

- Rochester is a critical supplier to DLA and meets all industry and DLA standards.

Rochester Electronics, LLC is committed to supplying products that satisfy customer expectations for quality and are equal to those originally supplied by industry manufacturers.

*The original manufacturer's datasheet accompanying this document reflects the performance and specifications of the Rochester manufactured version of this device. Rochester Electronics guarantees the performance of its semiconductor products to the original OCM specifications. 'Typical' values are for reference purposes only. Certain minimum or maximum ratings may be based on product characterization, design, simulation, or sample testing.*



## 54F/74F350

### 4-Bit Shifter with TRI-STATE® Outputs

#### General Description

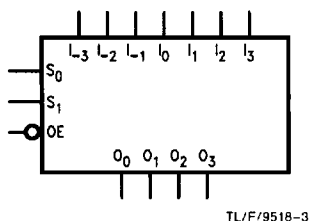
The 'F350 is a specialized multiplexer that accepts a 4-bit word and shifts it 0, 1, 2 or 3 places, as determined by two Select ( $S_0$ ,  $S_1$ ) inputs. For expansion to longer words, three linking inputs are provided for lower-order bits; thus two packages can shift an 8-bit word, four packages a 16-bit word, etc. Shifting by more than three places is accomplished by paralleling the TRI-STATE outputs of different packages and using the Output Enable ( $\overline{OE}$ ) inputs as a third Select level. With appropriate interconnections, the 'F350 can perform zero-backfill, sign-extend or end-around (barrel) shift functions.

#### Features

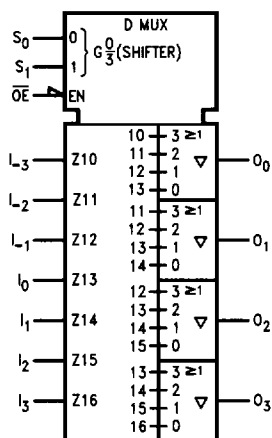
- Linking inputs for word expansion
- TRI-STATE outputs for extending shift range

**Ordering Code:** See Section 5

#### Logic Symbols

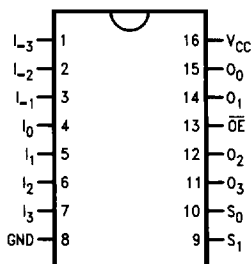


#### IEEE/IEC

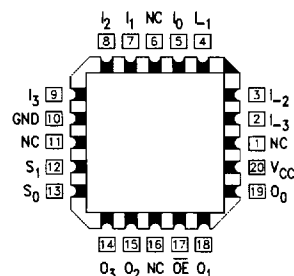


#### Connection Diagrams

##### 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 $I_{OH}/I_{OL}$ |
| $S_0, S_1$      | Select Inputs                    | 1.0/2.0          | 20 $\mu$ A/ - 1.2 mA                            |
| $I_{-3}-I_{-2}$ | Data Inputs                      | 1.0/2.0          | 20 $\mu$ A/ - 1.2 mA                            |
| $\overline{OE}$ | Output Enable Input (Active LOW) | 1.0/2.0          | 20 $\mu$ A/ - 1.2 mA                            |
| $O_0-O_3$       | TRI-STATE Outputs                | 150/40 (33.3)    | - 3 mA/ 24 mA (20 mA)                           |

## Functional Description

The 'F350 is operationally equivalent to a 4-input multiplexer with the inputs connected so that the select code causes successive one-bit shifts of the data word. This internal connection makes it possible to perform shifts of 0, 1, 2 or 3 places on words of any length.

A 4-bit data word is introduced at the  $I_n$  inputs and is shifted according to the code applied to the select inputs  $S_0, S_1$ . Outputs  $O_0-O_3$  are TRI-STATE, controlled by an active LOW output enable ( $\overline{OE}$ ). When  $\overline{OE}$  is LOW, data outputs will follow selected data inputs; when HIGH, the data outputs will be forced to the high impedance state. This feature allows shifts to be cascaded on the same output lines or

to a common bus. The shift function can be logical, with zeros pulled in at either or both ends of the shifting field; arithmetic, where the sign bit is repeated during a shift down; or end around, where the data word forms a continuous loop.

## Logic Equations

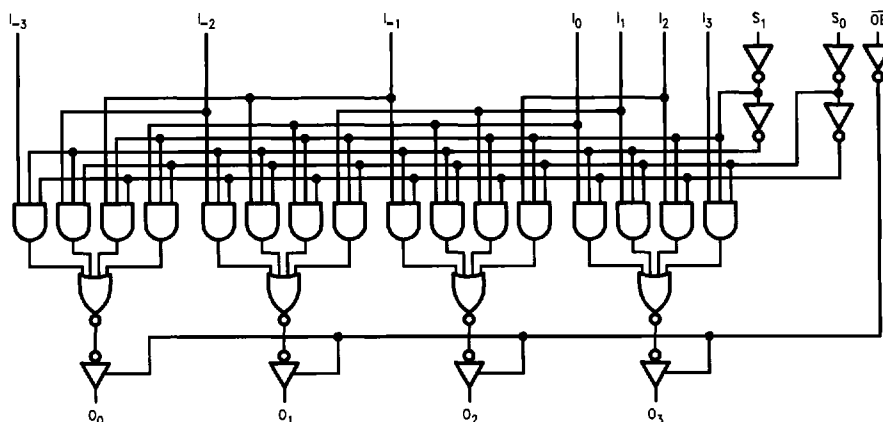
$$\begin{aligned}
 O_0 &= \overline{S_0}\overline{S_1}I_0 + S_0\overline{S_1}I_{-1} + \overline{S_0}S_1I_{-2} + S_0S_1I_{-3} \\
 O_1 &= \overline{S_0}\overline{S_1}I_1 + S_0\overline{S_1}I_0 + \overline{S_0}S_1I_{-1} + S_0S_1I_{-2} \\
 O_2 &= \overline{S_0}\overline{S_1}I_2 + S_0\overline{S_1}I_1 + \overline{S_0}S_1I_0 + S_0S_1I_{-1} \\
 O_3 &= \overline{S_0}\overline{S_1}I_3 + S_0\overline{S_1}I_2 + \overline{S_0}S_1I_1 + S_0S_1I_0
 \end{aligned}$$

## Truth Table

| Inputs          |       |       | Outputs  |          |          |       |
|-----------------|-------|-------|----------|----------|----------|-------|
| $\overline{OE}$ | $S_1$ | $S_0$ | $O_0$    | $O_1$    | $O_2$    | $O_3$ |
| H               | X     | X     | Z        | Z        | Z        | Z     |
| L               | L     | L     | $I_0$    | $I_1$    | $I_2$    | $I_3$ |
| L               | L     | H     | $I_{-1}$ | $I_0$    | $I_1$    | $I_2$ |
| L               | H     | L     | $I_{-2}$ | $I_{-1}$ | $I_0$    | $I_1$ |
| L               | H     | H     | $I_{-3}$ | $I_{-2}$ | $I_{-1}$ | $I_0$ |

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

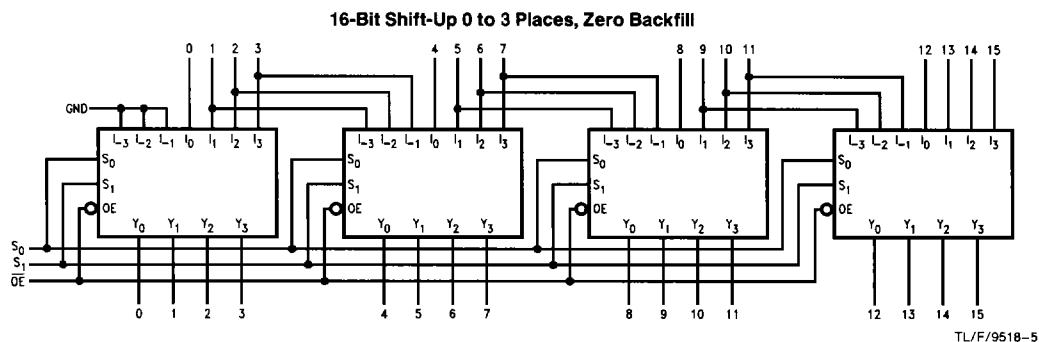
## Logic Diagram



TL/F/9518-4

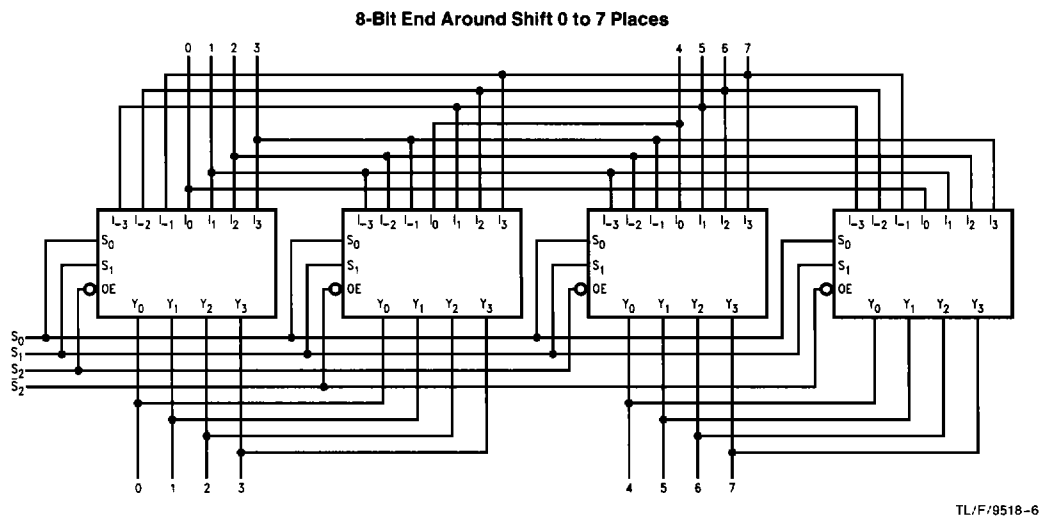
Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

## Applications



Function Table

| S <sub>1</sub> | S <sub>0</sub> | Shift Function |
|----------------|----------------|----------------|
| L              | L              | No Shift       |
| L              | H              | Shift 1 Place  |
| H              | L              | Shift 2 Places |
| H              | H              | Shift 3 Places |

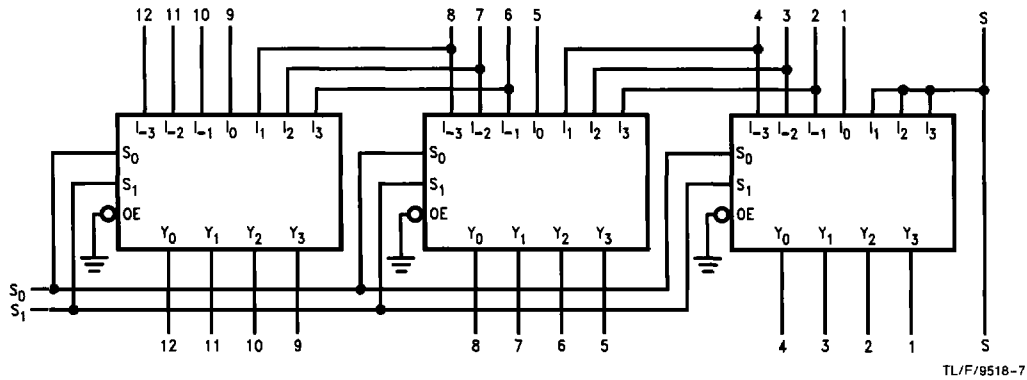


# Applications (Continued)

Function Table

| S <sub>2</sub> | S <sub>1</sub> | S <sub>0</sub> | Shift Function     |
|----------------|----------------|----------------|--------------------|
| L              | L              | L              | No Shift           |
| L              | L              | H              | Shift End Around 1 |
| L              | H              | L              | Shift End Around 2 |
| L              | H              | H              | Shift End Around 3 |
| H              | L              | L              | Shift End Around 4 |
| H              | L              | H              | Shift End Around 5 |
| H              | H              | L              | Shift End Around 6 |
| H              | H              | H              | Shift End Around 7 |

13-Bit Twos Complement Scaler



Function Table

| S <sub>1</sub> | S <sub>0</sub> | Scale |
|----------------|----------------|-------|
| L              | L ÷ 8          | 1/8   |
| L              | H ÷ 4          | 1/4   |
| H              | L ÷ 2          | 1/2   |
| H              | H No Change    | 1     |

## 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 10% 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>BI</sub>  | Input HIGH Current Breakdown Test |                                                                                                                                                               |                                        | 100        | μA    | Max             | V <sub>IN</sub> = 7.0V                                                                                                                                         |
| I <sub>IL</sub>  | Input LOW Current                 |                                                                                                                                                               |                                        | −1.2       | 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>CCH</sub> | Power Supply Current              |                                                                                                                                                               | 34                                     | 42         | mA    | Max             | V <sub>O</sub> = HIGH                                                                                                                                          |
| I <sub>CCL</sub> | Power Supply Current              |                                                                                                                                                               | 40                                     | 57         | mA    | Max             | V <sub>O</sub> = LOW                                                                                                                                           |
| I <sub>CCZ</sub> | Power Supply Current              |                                                                                                                                                               | 40                                     | 57         | 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><br>t <sub>PHL</sub> | Propagation Delay<br>I <sub>n</sub> to O <sub>n</sub> | 3.0<br>2.5                                                                  | 4.5<br>4.0 | 6.0<br>5.5  |                                                                  |     | 3.0<br>2.5                                                       | 7.0<br>6.5  | ns    | 2-3    |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>S <sub>n</sub> to O <sub>n</sub> | 4.0<br>3.0                                                                  | 7.8<br>6.5 | 10.0<br>8.5 |                                                                  |     | 4.0<br>3.0                                                       | 13.5<br>9.5 | ns    | 2-3    |
| t <sub>PZH</sub><br>t <sub>PZL</sub> | Output Enable Time                                    | 2.5<br>4.0                                                                  | 5.0<br>7.0 | 7.0<br>9.0  |                                                                  |     | 2.5<br>4.0                                                       | 8.0<br>10.0 | ns    | 2-5    |
| t <sub>PHZ</sub><br>t <sub>PLZ</sub> | Output Disable Time                                   | 2.0<br>2.0                                                                  | 3.9<br>4.0 | 5.5<br>5.5  |                                                                  |     | 2.0<br>2.0                                                       | 6.5<br>7.5  |       |        |