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|---------------|-----------------------|
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| Status        | Product Specification |
| FAST Products |                       |

# FAST 74F350

## Shifter

### 4-Bit Shifter

### FEATURES

- Shifts 4 bits of data to 0,1,2,3 places under control of two select lines
- 3-state outputs for bus organized systems

### DESCRIPTION

The 74F350 is a combination logic circuit that shifts a 4-bit word from 0 to 3 places. No clocking is required as with shift registers. The 'F350 can be used to shift any number of bits any number of places up or down by suitable interconnection. Shifting can be:

- Logical-- with logic zeros filled in at either end of the shifting field.
- Arithmetic-- where the sign bit is extended during a shift down.
- End around-- where the data word forms a continuous loop.

| TYPE   | TYPICAL PROPAGATION DELAY | TYPICAL SUPPLY CURRENT (TOTAL) |
|--------|---------------------------|--------------------------------|
| 74F350 | 5.2ns                     | 24mA                           |

### ORDERING INFORMATION

| PACKAGES           | COMMERCIAL RANGE<br>$V_{CC} = 5V \pm 10\%$ ; $T_A = 0^\circ C$ to $+70^\circ C$ |
|--------------------|---------------------------------------------------------------------------------|
| 16-Pin Plastic DIP | N74F350N                                                                        |
| 16-Pin Plastic SO  | N74F350D                                                                        |

### INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

| PINS            | DESCRIPTION                      | 74F(U.L.)<br>HIGH/LOW | LOAD VALUE<br>HIGH/LOW |
|-----------------|----------------------------------|-----------------------|------------------------|
| $I_{-n}, I_n$   | Data inputs                      | 1.0/2.0               | 20 $\mu$ A/1.2mA       |
| $S_0, S_1$      | Select inputs (active Low)       | 1.0/2.0               | 20 $\mu$ A/1.2mA       |
| $\overline{OE}$ | Output Enable input (active Low) | 1.0/2.0               | 20 $\mu$ A/1.2mA       |
| $Y_0 - Y_3$     | Data outputs                     | 150/40                | 3.0mA/24mA             |

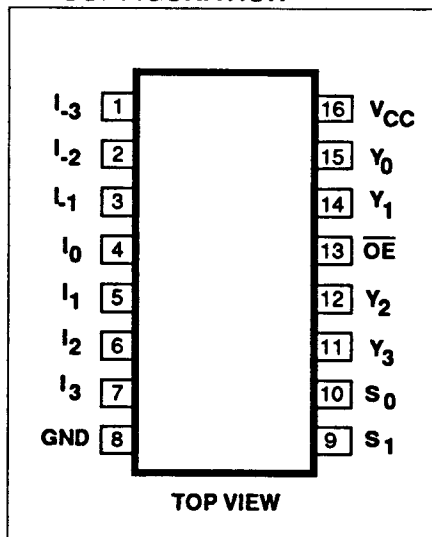
#### NOTE:

One (1.0) FAST Unit Load is defined as: 20 $\mu$ A in the High state and 0.6mA in the Low state.

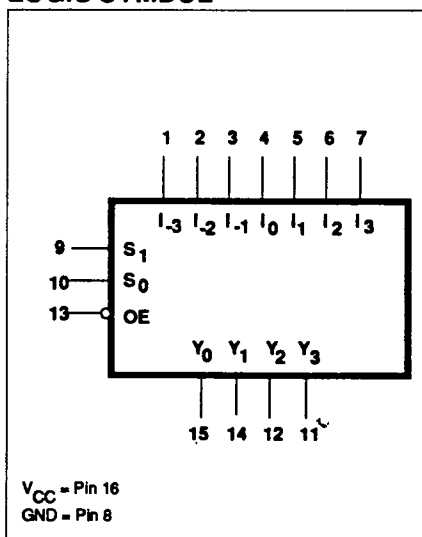
The 3-state outputs are useful for bus interface applications or expansion to a larger number of shift positions in end around shifting. The active Low Output

Enable ( $\overline{OE}$ ) controls the state of the outputs. The outputs are in the high impedance "off" state when  $\overline{OE}$  is High, and they are active when  $\overline{OE}$  is Low.

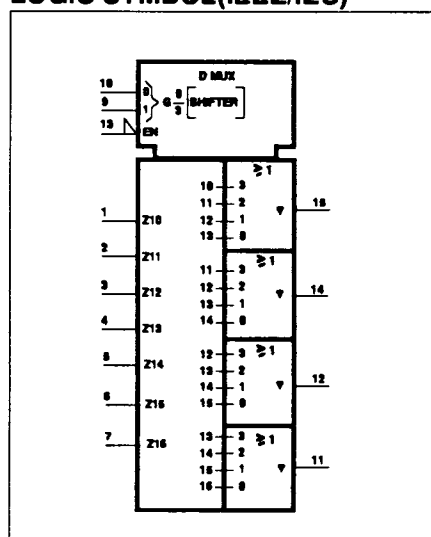
### PIN CONFIGURATION



### LOGIC SYMBOL



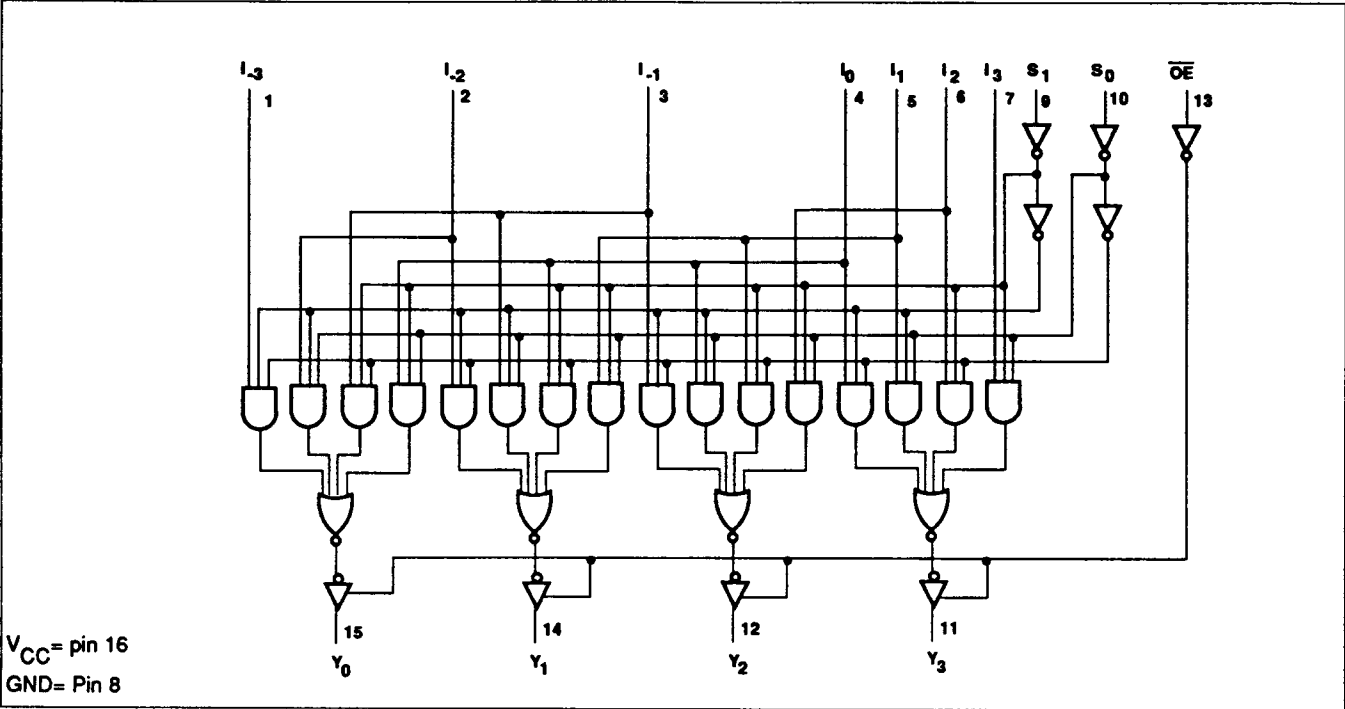
### LOGIC SYMBOL (IEEE/IEC)



Shifter

FAST 74F350

LOGIC DIAGRAM

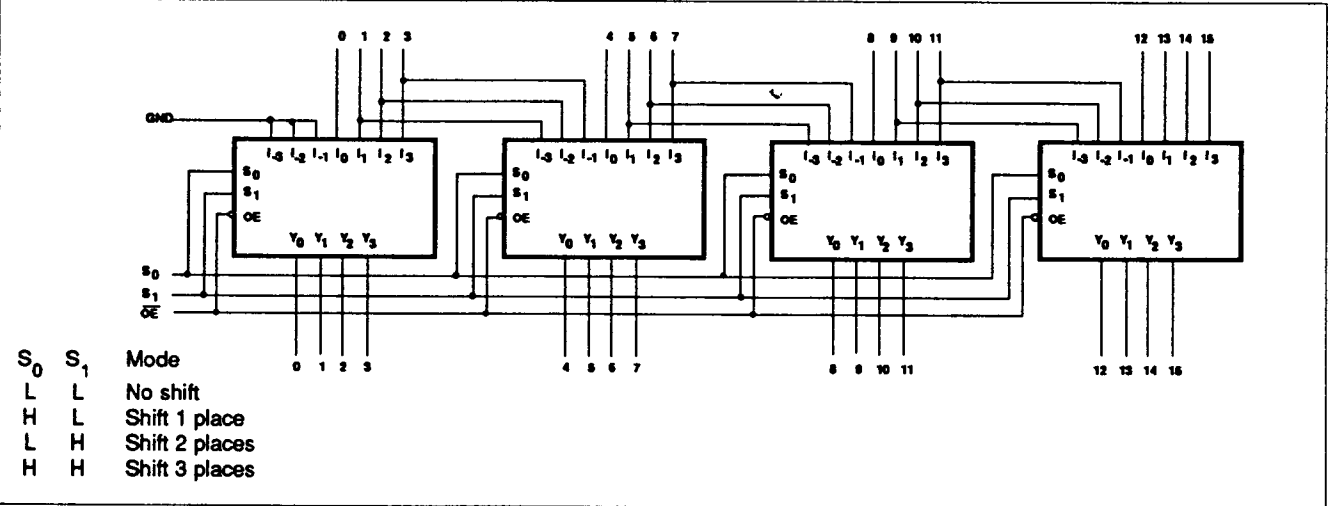


FUNCTION TABLE

| INPUTS |                |                |                |                |                |                |                 |                 |                 | OUTPUTS        |                 |                 |                 |
|--------|----------------|----------------|----------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|----------------|-----------------|-----------------|-----------------|
| OE     | S <sub>1</sub> | S <sub>0</sub> | I <sub>3</sub> | I <sub>2</sub> | I <sub>1</sub> | I <sub>0</sub> | I <sub>-1</sub> | I <sub>-2</sub> | I <sub>-3</sub> | Y <sub>3</sub> | Y <sub>2</sub>  | Y <sub>1</sub>  | Y <sub>0</sub>  |
| H      | X              | X              | X              | X              | X              | X              | X               | X               | X               | Z              | Z               | Z               | Z               |
| L      | L              | L              | D <sub>3</sub> | D <sub>2</sub> | D <sub>1</sub> | D <sub>0</sub> | X               | X               | X               | D <sub>3</sub> | D <sub>2</sub>  | D <sub>1</sub>  | D <sub>0</sub>  |
| L      | L              | H              | X              | D <sub>2</sub> | D <sub>1</sub> | D <sub>0</sub> | D <sub>-1</sub> | X               | X               | D <sub>2</sub> | D <sub>1</sub>  | D <sub>0</sub>  | D <sub>-1</sub> |
| L      | H              | L              | X              | X              | D <sub>1</sub> | D <sub>0</sub> | D <sub>-1</sub> | D <sub>-2</sub> | X               | D <sub>1</sub> | D <sub>0</sub>  | D <sub>-1</sub> | D <sub>-2</sub> |
| L      | H              | H              | X              | X              | X              | D <sub>0</sub> | D <sub>-1</sub> | D <sub>-2</sub> | D <sub>-3</sub> | D <sub>0</sub> | D <sub>-1</sub> | D <sub>-2</sub> | D <sub>-3</sub> |

H = High voltage level  
L = Low voltage level  
X = Don't care  
Z = High impedance "off" state  
D<sub>n</sub> = High or Low state of referenced I<sub>n</sub> input

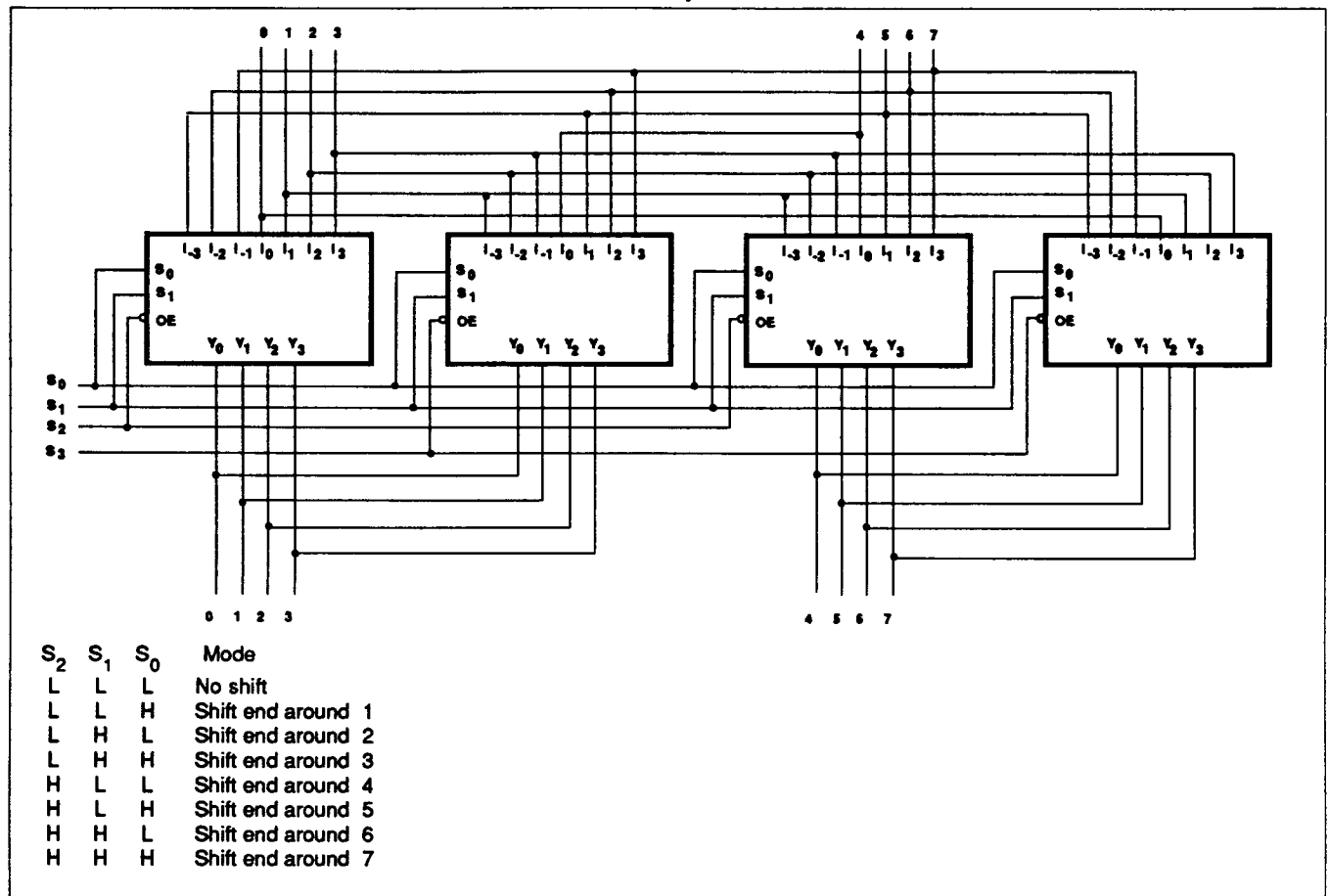
APPLICATION for 16-bit shift up 0,1,2, or 3 places



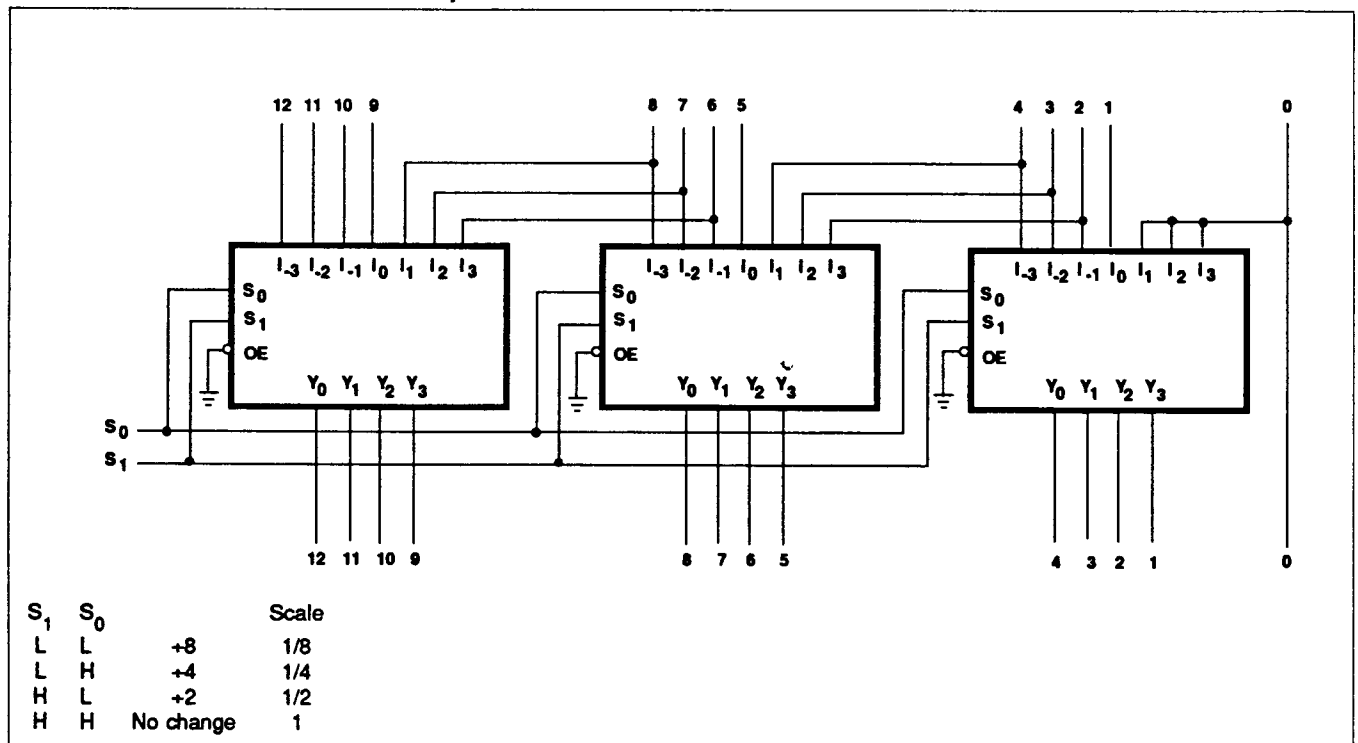
## Shifter

## FAST 74F350

## APPLICATION for 8-bit end around shift 0,1,2,3,4,5,6,7 places



## APPLICATION for 13-bit two's complement scaler



## Shifter

## FAST 74F350

**ABSOLUTE MAXIMUM RATINGS** (Operation beyond the limits set forth in this table may impair the useful life of the device. Unless otherwise noted these limits are over the operating free-air temperature range.)

| SYMBOL    | PARAMETER                                      | RATING             | UNIT |
|-----------|------------------------------------------------|--------------------|------|
| $V_{CC}$  | Supply voltage                                 | -0.5 to +7.0       | V    |
| $V_{IN}$  | Input voltage                                  | -0.5 to +7.0       | V    |
| $I_{IN}$  | Input current                                  | -30 to +5          | mA   |
| $V_{OUT}$ | Voltage applied to output in High output state | -0.5 to + $V_{CC}$ | V    |
| $I_{OUT}$ | Current applied to output in Low output state  | 48                 | mA   |
| $T_A$     | Operating free-air temperature range           | 0 to +70           | °C   |
| $T_{STG}$ | Storage temperature                            | -65 to +150        | °C   |

**RECOMMENDED OPERATING CONDITIONS**

| SYMBOL   | PARAMETER                            | LIMITS |     |     | UNIT |
|----------|--------------------------------------|--------|-----|-----|------|
|          |                                      | Min    | Nom | Max |      |
| $V_{CC}$ | Supply voltage                       | 4.5    | 5.0 | 5.5 | V    |
| $V_H$    | High-level input voltage             | 2.0    |     |     | V    |
| $V_L$    | Low-level input voltage              |        |     | 0.8 | V    |
| $I_{IK}$ | Input clamp current                  |        |     | -18 | mA   |
| $I_{OH}$ | High-level output current            |        |     | -3  | mA   |
| $I_{OL}$ | Low-level output current             |        |     | 24  | mA   |
| $T_A$    | Operating free-air temperature range | 0      |     | 70  | °C   |

**DC ELECTRICAL CHARACTERISTICS** (Over recommended operating free-air temperature range unless otherwise noted.)

| SYMBOL           | PARAMETER                                            | TEST CONDITIONS <sup>1</sup>                            |                       | LIMITS |                  |      | UNIT |
|------------------|------------------------------------------------------|---------------------------------------------------------|-----------------------|--------|------------------|------|------|
|                  |                                                      |                                                         |                       | Min    | Typ <sup>2</sup> | Max  |      |
| V <sub>OH</sub>  | High-level output voltage                            | V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX            | ±10%V <sub>CC</sub>   | 2.4    |                  |      | V    |
|                  |                                                      | V <sub>IH</sub> = MIN, I <sub>OH</sub> = MAX            | ±5%V <sub>CC</sub>    | 2.7    | 3.4              |      | V    |
| V <sub>OL</sub>  | Low-level output voltage                             | V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX            | ±10%V <sub>CC</sub>   |        | 0.35             | 0.50 | V    |
|                  |                                                      | V <sub>IH</sub> = MIN, I <sub>OL</sub> = MAX            | ±5%V <sub>CC</sub>    |        | 0.35             | 0.50 | V    |
| V <sub>IK</sub>  | Input clamp voltage                                  | V <sub>CC</sub> = MIN, I <sub>I</sub> = I <sub>IK</sub> |                       |        | -0.73            | -1.2 | V    |
| I <sub>I</sub>   | Input current at maximum input voltage               | V <sub>CC</sub> = MAX, V <sub>I</sub> = 7.0V            |                       |        |                  | 100  | μA   |
| I <sub>IH</sub>  | High-level input current                             | V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7V            |                       |        |                  | 20   | μA   |
| I <sub>IL</sub>  | Low-level input current                              | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.5V            |                       |        |                  | -1.2 | mA   |
| I <sub>OZH</sub> | Off-state output current, High-level voltage applied | V <sub>CC</sub> = MAX, V <sub>O</sub> = 2.7V            |                       |        |                  | 50   | μA   |
| I <sub>OZL</sub> | Off-state output current, Low-level voltage applied  | V <sub>CC</sub> = MAX, V <sub>O</sub> = 0.5V            |                       |        |                  | -50  | μA   |
| I <sub>OS</sub>  | Short circuit output current <sup>3</sup>            | V <sub>CC</sub> = MAX                                   |                       | -60    |                  | -150 | mA   |
| I <sub>CC</sub>  | Supply current (total)                               | I <sub>CCH</sub>                                        | V <sub>CC</sub> = MAX |        | 22               | 35   | mA   |
|                  |                                                      | I <sub>CCL</sub>                                        |                       |        | 26               | 41   | mA   |
|                  |                                                      | I <sub>CCZ</sub>                                        |                       |        | 26               | 42   | mA   |

**NOTES:**

- For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
- All typical values are at  $V_{CC} = 5\text{V}$ ,  $T_A = 25^\circ\text{C}$ .
- Not more than one output should be shorted at a time. For testing  $I_{OS}$ , the use of high-speed test apparatus and/or sample-and-hold techniques are preferable in order to minimize internal heating and more accurately reflect operational values. Otherwise, prolonged shorting of a High output may raise the chip temperature well above normal and thereby cause invalid readings in other parameter tests. In any sequence of parameter tests,  $I_{OS}$  tests should be performed last.

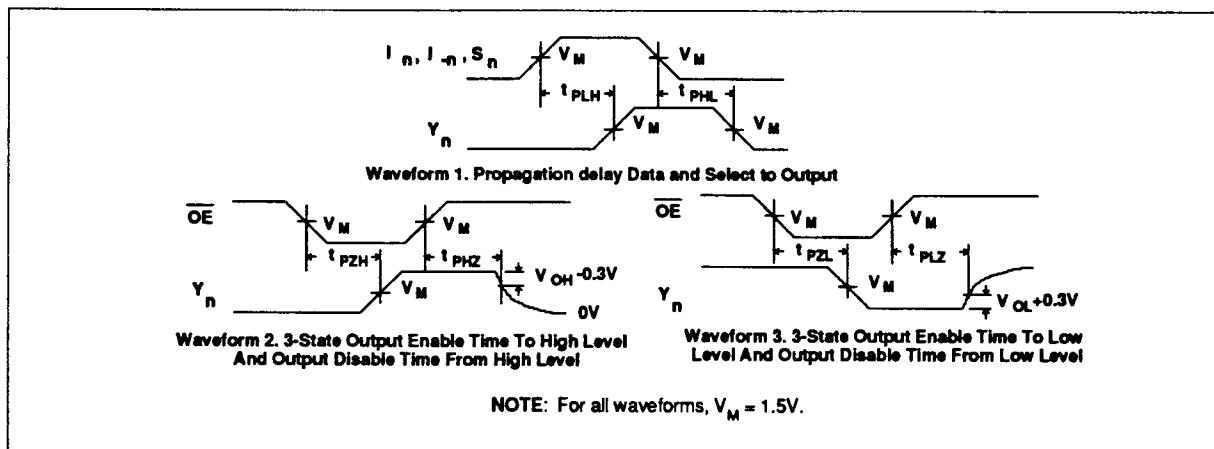
## Shifter

## FAST 74F350

## AC ELECTRICAL CHARACTERISTICS

| SYMBOL                 | PARAMETER                                   | TEST CONDITION           | LIMITS                                                                                          |            |             |                                                                                                                                |             |    | UNIT |
|------------------------|---------------------------------------------|--------------------------|-------------------------------------------------------------------------------------------------|------------|-------------|--------------------------------------------------------------------------------------------------------------------------------|-------------|----|------|
|                        |                                             |                          | $T_A = +25^{\circ}\text{C}$<br>$V_{CC} = 5\text{V}$<br>$C_L = 50\text{pF}$<br>$R_L = 500\Omega$ |            |             | $T_A = 0^{\circ}\text{C to } +70^{\circ}\text{C}$<br>$V_{CC} = 5\text{V} \pm 10\%$<br>$C_L = 50\text{pF}$<br>$R_L = 500\Omega$ |             |    |      |
|                        |                                             |                          | Min                                                                                             | Typ        | Max         | Min                                                                                                                            | Max         |    |      |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation delay<br>$I_n$ to $Y_n$         | Waveform 1               | 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 |      |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation delay<br>$S_n$ to $Y_n$         | Waveform 1               | 4.0<br>3.0                                                                                      | 7.8<br>6.5 | 10.0<br>8.5 | 4.0<br>3.0                                                                                                                     | 11.0<br>9.5 | ns |      |
| $t_{PZH}$<br>$t_{PZL}$ | Output Enable time to<br>High or Low level  | Waveform 2<br>Waveform 3 | 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 |      |
| $t_{PHZ}$<br>$t_{PLZ}$ | Output Disable time to<br>High or Low level | Waveform 2<br>Waveform 3 | 2.0<br>2.0                                                                                      | 3.9<br>4.0 | 5.5<br>5.5  | 2.0<br>2.0                                                                                                                     | 6.5<br>6.5  | ns |      |

## AC WAVEFORMS



## TEST CIRCUIT AND WAVEFORMS

