MOTOROLA

# MC54/74F253

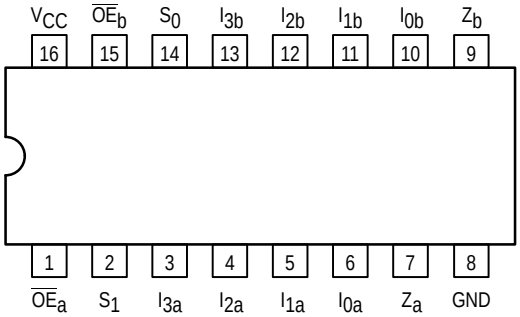
# DUAL 4-INPUT MULTIPLEXER WITH 3-STATE OUTPUTS

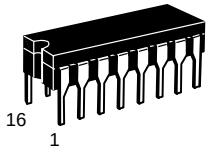
The MC54/74F253 is a Dual 4-Input Multiplexer with 3-State Outputs. It can select two bits of data from four sources using common select inputs. The outputs may be individually switched to a high-impedance state with a HIGH on the respective Output Enable ($\overline{OE}$) inputs, allowing the outputs to interface directly with bus-oriented systems.

**DUAL 4-INPUT MULTIPLEXER WITH 3-STATE OUTPUTS**

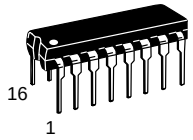
**FAST™ SCHOTTKY TTL**

**CONNECTION DIAGRAM DIP** (TOP VIEW)

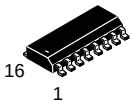



**J SUFFIX**
CERAMIC
CASE 620-09




**N SUFFIX**
PLASTIC
CASE 648-08




**D SUFFIX**
SOIC
CASE 751B-03

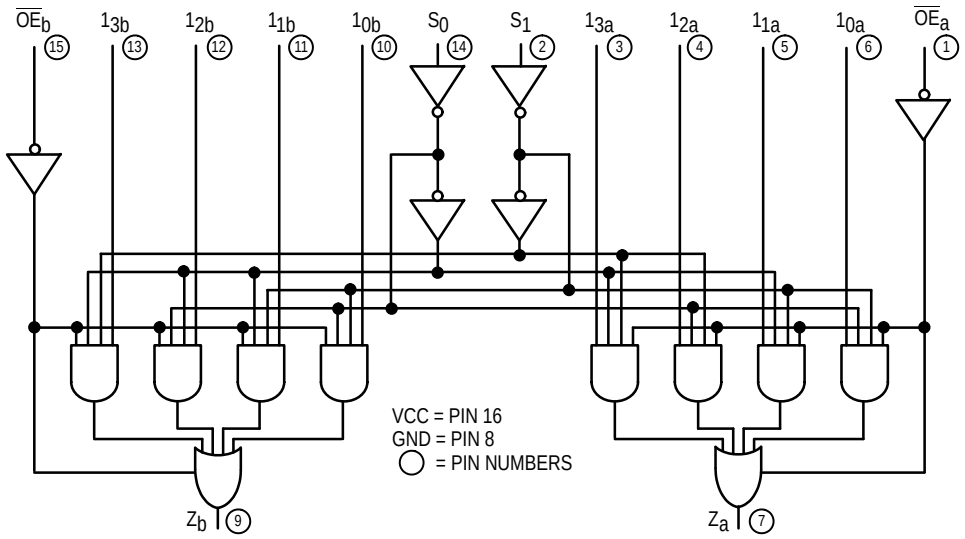
**ORDERING INFORMATION**

| | |
|---|---|
| MC54FXXXJ | Ceramic |
| MC74FXXXN | Plastic |
| MC74FXXXD | SOIC |

**GUARANTEED OPERATING RANGES**

| Symbol | Parameter | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage | 54, 74 | 4.5 | 5.0 | 5.5 | V |
| $T_A$ | Operating Ambient Temperature Range | 54 | –55 | 25 | 125 | °C |
| | | 74 | 0 | 25 | 70 | |
| $I_{OH}$ | Output Current — High | 54, 74 | | | –3.0 | mA |
| $I_{OL}$ | Output Current — Low | 54, 74 | | | 24 | mA |

## LOGIC DIAGRAM




## FUNCTIONAL DESCRIPTION

The F253 contains two identical 4-input Multiplexers with 3-State Outputs. They select two bits from four sources selected by common Select Inputs ($S_0$, $S_1$). The 4-input multiplexers have individual Output Enable ($\overline{OE}_a$, $\overline{OE}_b$) inputs which, when HIGH, force the outputs to a high impedance (high Z) state.

The F253 is the logic implementation of a 2-pole, 4-position switch, where the position of the switch is determined by the logic levels supplied to the two select inputs. The logic equations for the outputs are shown below:

$$Z_a = \overline{OE}_a \bullet (I_{0a} \bullet \overline{S}_1 \bullet \overline{S}_0 + I_{1a} \bullet \overline{S}_1 \bullet S_0 + I_{2a} \bullet S_1 \bullet \overline{S}_0 + I_{3a} \bullet S_1 \bullet S_0)$$

$$Z_b = \overline{OE}_b \bullet (I_{0b} \bullet \overline{S}_1 \bullet \overline{S}_0 + I_{1b} \bullet \overline{S}_1 \bullet S_0 + I_{2b} \bullet S_1 \bullet \overline{S}_0 + I_{3b} \bullet S_1 \bullet S_0)$$

If the outputs of 3-state devices are tied together, all but one device must be in the high impedance state to avoid high currents that would exceed the maximum ratings. Designers should ensure that Output Enable signals to 3-state devices whose outputs are tied together are designed so that there is no overlap.

## FUNCTION TABLE

| Select Inputs | | Data Inputs | | | | Output Enable | Output |
|---|---|---|---|---|---|---|---|
| $S_0$ | $S_1$ | $I_0$ | $I_1$ | $I_2$ | $I_3$ | $\overline{OE}$ | Z |
| X | X | X | X | X | X | H | Z |
| L | L | L | X | X | X | L | L |
| L | L | H | X | X | X | L | H |
| H | L | X | L | X | X | L | L |
| H | L | X | H | X | X | L | H |
| L | H | X | X | L | X | L | L |
| L | H | X | X | H | X | L | H |
| H | H | X | X | X | L | L | L |
| H | H | X | X | X | H | L | H |

H = HIGH Voltage Level
L = LOW Voltage Level
X = Don't Care
Z = High Impedance (off)
Address inputs $S_0$ and $S_1$ are common to both sections.

**DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE** (unless otherwise specified)

| Symbol | Parameter | | Limits Min | Typ | Max | Unit | Test Conditions | |
|---|---|---|---|---|---|---|---|---|
| $V_{IH}$ | Input HIGH Voltage | | 2.0 | | | V | Guaranteed Input HIGH Voltage | |
| $V_{IL}$ | Input LOW Voltage | | | | 0.8 | V | Guaranteed Input LOW Voltage | |
| $V_{IK}$ | Input Clamp Diode Voltage | | | | –1.2 | V | $I_{IN}$ = –18 mA | $V_{CC}$ = MIN |
| $V_{OH}$ | Output HIGH Voltage | 54, 74 | 2.4 | | | V | $I_{OH}$ = –3.0 mA | $V_{CC}$ = 4.50 V |
| | | 74 | 2.7 | | | V | $I_{OH}$ = –3.0 mA | $V_{CC}$ = 4.75 V |
| $V_{OL}$ | Output LOW Voltage | | | | 0.5 | V | $I_{OL}$ = 24 mA | $V_{CC}$ = MIN |
| $I_{OZH}$ | Output Off Current — HIGH | | | | 50 | µA | $V_{OUT}$ = 2.7 V | $V_{CC}$ = MAX |
| $I_{OZL}$ | Output Off Current — LOW | | | | –50 | µA | $V_{OUT}$ = 0.5 V | $V_{CC}$ = MAX |
| $I_{IH}$ | Input HIGH Current | | | | 20 | µA | $V_{IN}$ = 2.7 V | $V_{CC}$ = MAX |
| | | | | | 100 | µA | $V_{IN}$ = 7.0 V | |
| $I_{IL}$ | Input LOW Current | | | | –0.6 | mA | $V_{IN}$ = 0.5 V | $V_{CC}$ = MAX |
| $I_{OS}$ | Output Short Circuit Current (Note 2) | | –60 | | –150 | mA | $V_{OUT}$ = 0 V | $V_{CC}$ = MAX |
| $I_{CC}$ | Power Supply Current<br>Total, Output HIGH | | | | 16 | mA | $OE_n$ = GND<br>$I_O$ = 4.5 V; $S_n$, $I_1$ – $I_3$ = GND | |
| | Total, Output LOW | | | | 23 | | $I_n$, $S_n$, $OE_n$ = GND<br>$V_{CC}$ = MAX | |
| | Total at HIGH-Z | | | | 23 | | $OE_n$ = 4.5 V, $V_{CC}$ = MAX<br>$I_n$, $S_n$ = GND | |

**AC CHARACTERISTICS**

| Symbol | Parameter | 54/74F<br>$T_A$ = +25°C<br>$V_{CC}$ = +5.0 V<br>$C_L$ = 50 pF | | 54F<br>$T_A$ = -55°C to +125°C<br>$V_{CC}$ = 5.0 V ± 10%<br>$C_L$ = 50 pF | | 74F<br>$T_A$ = 0°C to +70°C<br>$V_{CC}$ = 5.0 V ± 10%<br>$C_L$ = 50 pF | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | Min | Max | Min | Max | Min | Max | |
| $t_{PLH}$ | Propagation Delay | 4.5 | 11.5 | 3.5 | 15 | 4.5 | 13.5 | ns |
| $t_{PHL}$ | $S_n$ to $Z_n$ | 3.0 | 9.0 | 2.5 | 11 | 3.0 | 10 | |
| $t_{PLH}$ | Propagation Delay | 3.0 | 7.0 | 2.5 | 9.0 | 3.0 | 8.0 | ns |
| $t_{PHL}$ | $I_n$ to $Z_n$ | 2.5 | 6.0 | 2.5 | 8.0 | 2.5 | 7.0 | |
| $t_{PZH}$ | Output Enable Time | 3.0 | 8.0 | 2.5 | 10 | 3.0 | 9.0 | ns |
| $t_{PZL}$ | | 3.0 | 8.0 | 2.5 | 10 | 3.0 | 9.0 | |
| $t_{PHZ}$ | Output Disable Time | 2.0 | 5.0 | 2.0 | 6.5 | 2.0 | 6.0 | ns |
| $t_{PLZ}$ | | 2.0 | 6.0 | 2.0 | 8.0 | 2.0 | 7.0 | |