

## Quad 2-Input Multiplexer

### Features

- Function, pinout, and drive compatible with FCT and F logic
- FCT-C speed at 4.3 ns max.  
FCT-A speed at 5.0 ns max.
- Reduced  $V_{OH}$  (typically = 3.3V) versions of equivalent FCT functions
- Edge-rate control circuitry for significantly improved noise characteristics
- Power-off disable feature
- Matched rise and fall times
- Fully compatible with TTL input and output logic levels
- ESD > 2000V
- Extended commercial range of  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- Sink current 64 mA  
Source current 32 mA

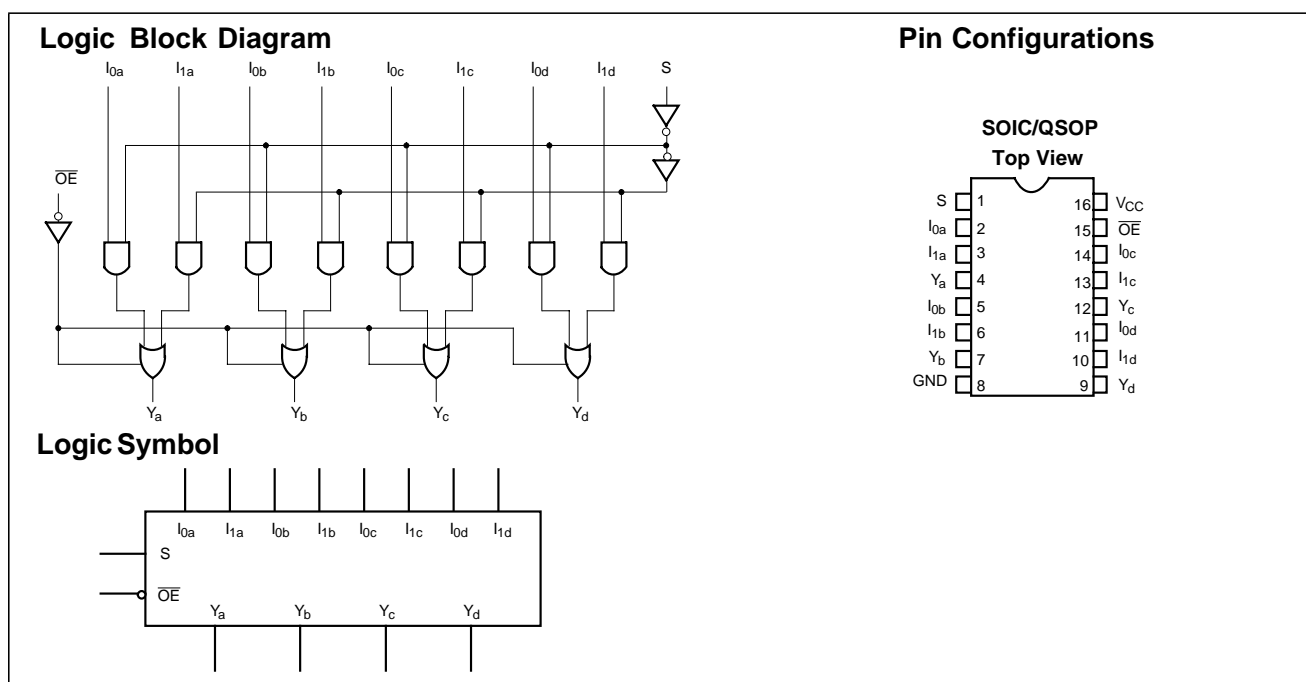
### Functional Description

The FCT257T has four identical two-input multiplexers which select four bits of data from two sources under the control of a common data Select input (S). The  $I_0$  inputs are selected when the Select input is LOW and the  $I_1$  inputs are selected when the Select input is HIGH. Data appears at the output in true non-inverted form for the FCT257T.

The FCT257T is a logic implementation of a four-pole, two position switch where the position of the switch is determined by the logic levels supplied to the select input. Outputs are forced to a high-impedance "OFF" state when the Output Enable input ( $\overline{OE}$ ) is HIGH.

All but one device must be in the high-impedance state to avoid currents exceeding the maximum ratings if outputs are tied together. Design of the Output Enable signals must ensure that there is no overlap when outputs of three-state devices are tied together.

The outputs are designed with a power-off disable feature to allow for live insertion of boards.



### Pin Description

| Name            | Description                |
|-----------------|----------------------------|
| I               | Data Inputs                |
| S               | Common Select Input        |
| $\overline{OE}$ | Enable Inputs (Active LOW) |
| Y               | Data Outputs               |

### Function Table<sup>[1]</sup>

| $\overline{OE}$ | Inputs |       |       | Outputs<br>Y |
|-----------------|--------|-------|-------|--------------|
|                 | S      | $I_0$ | $I_1$ |              |
| H               | X      | X     | X     | H            |
| L               | H      | X     | L     | L            |
| L               | H      | X     | H     | H            |
| L               | L      | L     | X     | L            |
| L               | L      | H     | X     | H            |

**Note:**

1. H = HIGH Voltage Level, L = LOW Voltage Level, X = Don't Care, Z = High impedance (OFF) state.

**Maximum Ratings**<sup>[2,3]</sup>

(Above which the useful life may be impaired. For user guidelines, not tested.)

Storage Temperature ..... -65°C to +150°C  
 Ambient Temperature with  
 Power Applied ..... -65°C to +135°C  
 Supply Voltage to Ground Potential..... -0.5V to +7.0V  
 DC Input Voltage ..... -0.5V to +7.0V  
 DC Output Voltage ..... -0.5V to +7.0V

DC Output Current (Maximum Sink Current/Pin) ..... 120 mA  
 Power Dissipation ..... 0.5W  
 Static Discharge Voltage..... >2001V  
 (per MIL-STD-883, Method 3015)

**Operating Range**

| Range      | Range | Ambient Temperature | V <sub>CC</sub> |
|------------|-------|---------------------|-----------------|
| Commercial | All   | -40°C to +85°C      | 5V ± 5%         |

**Electrical Characteristics** Over the Operating Range

| Parameter        | Description                                 | Test Conditions   | Min. | Typ. <sup>[4]</sup> | Max. | Unit |
|------------------|---|---|------|---------------------|------|------|
| V <sub>OH</sub>  | Output HIGH Voltage                         | V <sub>CC</sub> =Min., I <sub>OH</sub> =-32 mA          | 2.0  |                     |      | V    |
| V <sub>OL</sub>  | Output LOW Voltage                          | V <sub>CC</sub> =Min., I <sub>OL</sub> =64 mA           |      | 0.3                 | 0.55 | V    |
| V <sub>IH</sub>  | Input HIGH Voltage                          |   | 2.0  |                     |      | V    |
| V <sub>IL</sub>  | Input LOW Voltage                           |   |      |                     | 0.8  | V    |
| V <sub>H</sub>   | Hysteresis <sup>[5]</sup>                   | All inputs  |      | 0.2                 |      | V    |
| V <sub>IK</sub>  | Input Clamp Diode Voltage                   | V <sub>CC</sub> =Min., I <sub>IN</sub> =-18 mA          |      | -0.7                | -1.2 | V    |
| I <sub>I</sub>   | Input HIGH Current                          | V <sub>CC</sub> =Max., V <sub>IN</sub> =V <sub>CC</sub> |      |                     | 5    | μA   |
| I <sub>IH</sub>  | Input HIGH Current                          | V <sub>CC</sub> =Max., V <sub>IN</sub> =2.7V            |      |                     | ±1   | μA   |
| I <sub>IL</sub>  | Input LOW Current                           | V <sub>CC</sub> =Max., V <sub>IN</sub> =0.5V            |      |                     | ±1   | μA   |
| I <sub>OZH</sub> | Off State HIGH-Level Output Current         | V <sub>CC</sub> = Max., V <sub>OUT</sub> = 2.7V         |      |                     | 10   | μA   |
| I <sub>OZL</sub> | Off State LOW-Level Output Current          | V <sub>CC</sub> = Max., V <sub>OUT</sub> = 0.5V         |      |                     | -10  | μA   |
| I <sub>OS</sub>  | Output Short Circuit Current <sup>[6]</sup> | V <sub>CC</sub> =Max., V <sub>OUT</sub> =0.0V           | -60  | -120                | -225 | mA   |
| I <sub>OFF</sub> | Power-Off Disable                           | V <sub>CC</sub> =0V, V <sub>OUT</sub> =4.5V             |      |                     | ±1   | μA   |

**Capacitance**<sup>[5]</sup>

| Parameter        | Description        | Typ. <sup>[4]</sup> | Max. | Unit |
|------------------|--------------------|---------------------|------|------|
| C <sub>IN</sub>  | Input Capacitance  | 5                   | 10   | pF   |
| C <sub>OUT</sub> | Output Capacitance | 9                   | 12   | pF   |

**Notes:**

- Unless otherwise noted, these limits are over the operating free-air temperature range.
- Unused inputs must always be connected to an appropriate logic voltage level, preferably either V<sub>CC</sub> or ground.
- Typical values are at V<sub>CC</sub>=5.0V, T<sub>A</sub>=+25°C ambient.
- This parameter is specified but not tested.
- Not more than one output should be shorted at a time. Duration of short should not exceed one second. The use of high-speed test apparatus and/or sample and hold techniques are preferable in order to minimize internal chip 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 parametric tests. In any sequence of parameter tests, I<sub>OS</sub> tests should be performed last.

**Power Supply Characteristics**

| Parameter       | Description                                      | Test Conditions  | Typ. <sup>[4]</sup> | Max.                | Unit   |
|-----------------|--|--|---------------------|---------------------|--------|
| $I_{CC}$        | Quiescent Power Supply Current                   | $V_{CC}=\text{Max.}, V_{IN}\leq 0.2\text{V}, V_{IN}\geq V_{CC}-0.2\text{V}$  | 0.1                 | 0.2                 | mA     |
| $\Delta I_{CC}$ | Quiescent Power Supply Current (TTL inputs HIGH) | $V_{CC}=\text{Max.}, V_{IN}=3.4\text{V}, f_1=0, \text{Outputs Open}^{[7]}$   | 0.5                 | 2.0                 | mA     |
| $I_{CCD}$       | Dynamic Power Supply Current <sup>[8]</sup>      | $V_{CC}=\text{Max.}, \text{One Input Toggling, 50\% Duty Cycle, Outputs Open, OE}=\text{GND}, V_{IN}\leq 0.2\text{V or } V_{IN}\geq V_{CC}-0.2\text{V}$                          | 0.06                | 0.12                | mA/MHz |
| $I_C$           | Total Power Supply Current <sup>[9]</sup>        | $V_{CC}=\text{Max.}, 50\% \text{ Duty Cycle, Outputs Open, One Input Toggling at } f_1=10 \text{ MHz, OE}=\text{GND}, V_{IN}\leq 0.2\text{V or } V_{IN}\geq V_{CC}-0.2\text{V}$  | 0.7                 | 1.4                 | mA     |
|                 |  | $V_{CC}=\text{Max.}, 50\% \text{ Duty Cycle, Outputs Open, One Input Toggling at } f_1=10 \text{ MHz, OE}=\text{GND}, V_{IN}=3.4\text{V or } V_{IN}=\text{GND}$                  | 1.0                 | 2.4                 | mA     |
|                 |  | $V_{CC}=\text{Max.}, 50\% \text{ Duty Cycle, Outputs Open, Four Bits Toggling at } f_1=2.5 \text{ MHz, OE}=\text{GND}, V_{IN}\leq 0.2\text{V or } V_{IN}\geq V_{CC}-0.2\text{V}$ | 0.7                 | 1.4 <sup>[10]</sup> | mA     |
|                 |  | $V_{CC}=\text{Max.}, 50\% \text{ Duty Cycle, Outputs Open, Four Bits Toggling at } f_1=2.5 \text{ MHz, OE}=\text{GND}, V_{IN}=3.4\text{V or } V_{IN}=\text{GND}$                 | 1.7                 | 5.4 <sup>[10]</sup> | mA     |

**Switching Characteristics** Over the Operating Range

| Parameter              | Description              | CY74FCT257T          |      | CY74FCT257AT         |      | CY74FCT257CT         |      | Unit | Fig. No. <sup>[12]</sup> |
|------------------------|--------------------------|----------------------|------|----------------------|------|----------------------|------|------|--------------------------|
|                        |                          | Min. <sup>[11]</sup> | Max. | Min. <sup>[11]</sup> | Max. | Min. <sup>[11]</sup> | Max. |      |                          |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay I to Y | 1.5                  | 6.0  | 1.5                  | 5.0  | 1.5                  | 4.3  | ns   | 1, 3                     |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay S to O | 1.5                  | 10.5 | 1.5                  | 7.0  | 1.5                  | 5.2  | ns   | 1, 3                     |
| $t_{PZH}$<br>$t_{PZL}$ | Output Enable Time       | 1.5                  | 8.5  | 1.5                  | 7.0  | 1.5                  | 6.0  | ns   | 1, 7, 8                  |
| $t_{PHZ}$<br>$t_{PLZ}$ | Output Disable Time      | 1.5                  | 6.0  | 1.5                  | 5.5  | 1.5                  | 5.0  | ns   | 1, 7, 8                  |

**Ordering Information**

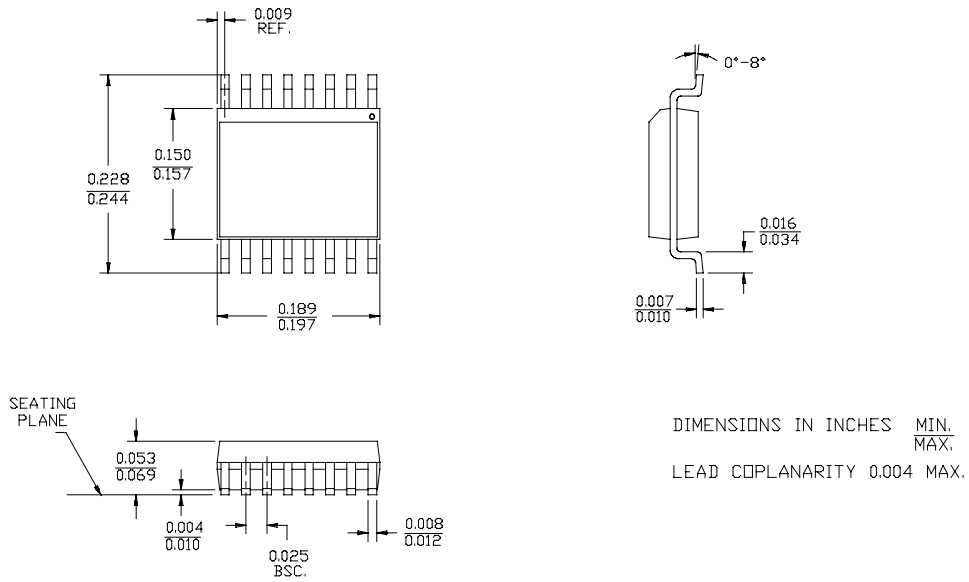
| Speed (ns) | Ordering Code        | Package Name | Package Type                  | Operating Range |
|------------|----------------------|--------------|-------------------------------|-----------------|
| 4.3        | CY74FCT257CTQCT      | Q1           | 16-Lead (150-Mil) QSOP        | Commercial      |
|            | CY74FCT257CTSOC/SOCT | S1           | 16-Lead (300-Mil) Molded SOIC |                 |
| 5.0        | CY74FCT257ATQCT      | Q1           | 16-Lead (150-Mil) QSOP        | Commercial      |
| 6.0        | CY74FCT257TQCT       | Q1           | 16-Lead (150-Mil) QSOP        | Commercial      |

**Notes:**

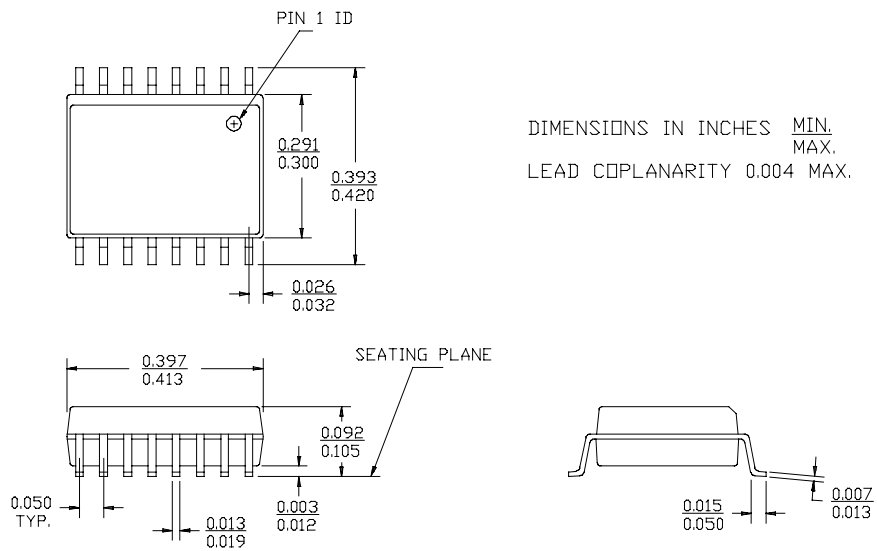
7. Per TTL driven input ( $V_{IN}=3.4\text{V}$ ); all other inputs at  $V_{CC}$  or GND.
8. This parameter is not directly testable, but is derived for use in Total Power Supply calculations.
9.  $I_C = I_{\text{QUIESCENT}} + I_{\text{INPUTS}} + I_{\text{DYNAMIC}}$   
 $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_0/2 + f_1 N_1)$   
 $I_{CC}$  = Quiescent Current with CMOS input levels  
 $\Delta I_{CC}$  = Power Supply Current for a TTL HIGH input ( $V_{IN}=3.4\text{V}$ )  
 $D_H$  = Duty Cycle for TTL inputs HIGH  
 $N_T$  = Number of TTL inputs at  $D_H$   
 $I_{CCD}$  = Dynamic Current caused by an input transition pair (HLH or LHL)  
 $f_0$  = Clock frequency for registered devices, otherwise zero  
 $f_1$  = Input signal frequency  
 $N_1$  = Number of inputs changing at  $f_1$   
 All currents are in milliamps and all frequencies are in megahertz.
10. Values for these conditions are examples of the  $I_{CC}$  formula. These limits are specified but not tested.
11. Minimum limits are specified but not tested on Propagation Delays.
12. See "Parameter Measurement Information" in the General Information section.

**Package Diagrams**

**16-Lead Quarter Size Outline Q1**



**16-Lead Molded SOIC S1**



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