

# High-Speed CMOS Quad 2-Input Multiplexers

QS54/74FCT157T  
QS54/74FCT158T  
QS54/74FCT257T  
QS54/74FCT2157T  
QS54/74FCT2257T

## FEATURES/BENEFITS

- Pin and function compatible to the 74FCT257, 74FCT157/8 and 74FCT2157/2257
- Industrial temperature  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$
- CMOS power levels:  $<7.5\text{mW}$  static
- Available in DIP, SOIC, QSOP, HQSOP
- Undershoot clamp diodes on all inputs
- TTL-compatible input and output levels
- Ground bounce controlled outputs
- Reduced output swing of 0-3.5V
- Military product compliant to MIL-STD-883, Class B

### FCT-T 157T, 158T, 257T

- JEDEC-FCT spec compatible
- A and C speed grades with 4.3ns for C
- $I_{OL} = 48\text{mA}$  Ind., 32mA Mil.

### FCT-T 2157T, 2257T

- Built-in  $25\Omega$  series resistor outputs reduce reflection and other system noise
- Std., A, and C speed grades with 4.3ns for C
- $I_{OL} = 12\text{mA}$  Ind.

## DESCRIPTION

The QSFCT157T/8T and QSFCT257T are high-speed CMOS TTL-compatible, quad, 2-input multiplexers. The 157/257 parts are non-inverting; the 158 is inverting. The 157/8 has TTL outputs; the 257 has 3-state outputs. The QSFCT2157T and QSFCT2257T are  $25\Omega$  resistor output versions useful for driving transmission lines and reducing system noise. All inputs have clamp diodes for undershoot noise suppression. All outputs have ground bounce suppression (see QSI Application Note AN-001). Outputs will not load an active bus when  $V_{CC}$  is removed from the device.

**Figure 1. Functional Block Diagram**

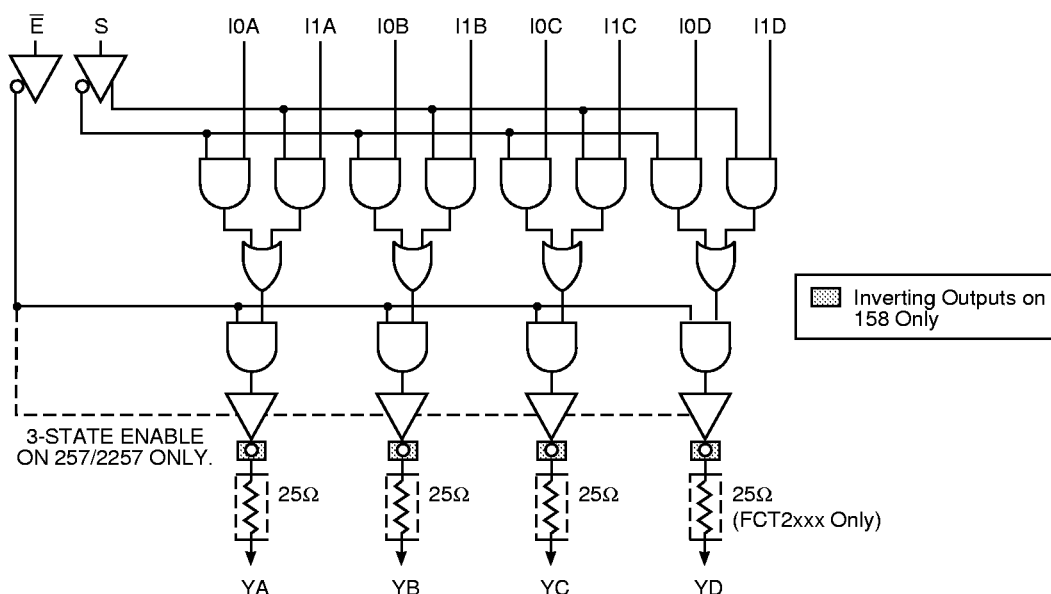
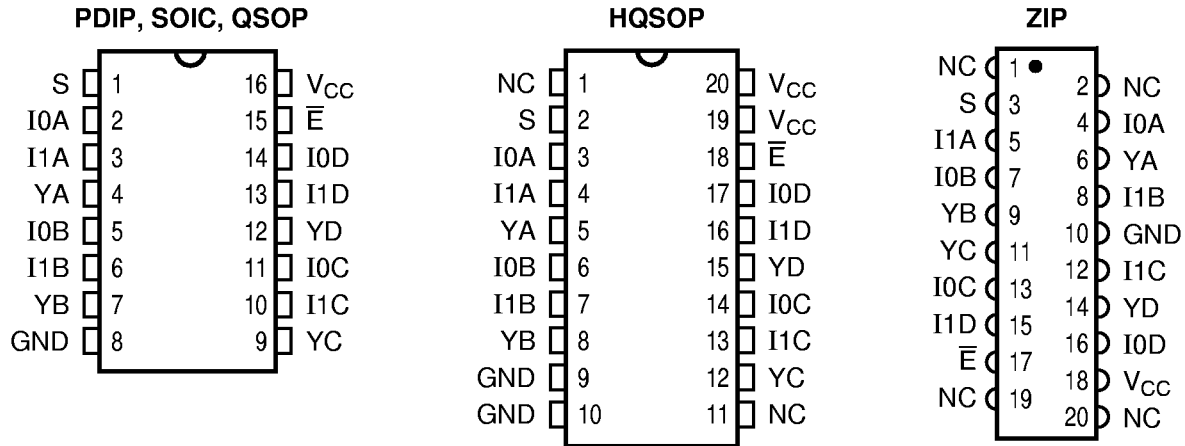


Figure 2. Pin Configurations (All Pins Top View)



**Note:**

Available in both 150 mil wide SOIC (package code S1) and 300 mil SOIC (package code SO).

Table 1. Pin Description

| Name      | I/O | Description  |
|-----------|-----|--------------|
| Ixx       | I   | Data Inputs  |
| S         | I   | Select Input |
| $\bar{E}$ | I   | Enable Input |
| YA-YD     | O   | Data Outputs |

Table 2. Function Tables

|           |   | FCT157/2157 |     |     |     | FCT158      |             |             |             | Function |
|-----------|---|-------------|-----|-----|-----|-------------|-------------|-------------|-------------|----------|
| $\bar{E}$ | S | YA          | YB  | YC  | YD  | YA          | YB          | YC          | YD          |          |
| H         | X | L           | L   | L   | L   | H           | H           | H           | H           | Disable  |
| L         | L | I0A         | I0B | I0C | I0D | $\bar{I0A}$ | $\bar{I0B}$ | $\bar{I0C}$ | $\bar{I0D}$ | Select 0 |
| L         | H | I1A         | I1B | I1C | I1D | $\bar{I1A}$ | $\bar{I1B}$ | $\bar{I1C}$ | $\bar{I1D}$ | Select 1 |

|           |   | FCT257/2257 |      |      |      | Function |
|-----------|---|-------------|------|------|------|----------|
| $\bar{E}$ | S | YA          | YB   | YC   | YD   |          |
| H         | X | Hi-Z        | Hi-Z | Hi-Z | Hi-Z | Disable  |
| L         | L | I0A         | I0B  | I0C  | I0D  | Select 0 |
| L         | H | I1A         | I1B  | I1C  | I1D  | Select 1 |

**Table 3. Absolute Maximum Ratings**

|                                                         |               |
|---------------------------------------------------------|---------------|
| Supply Voltage to Ground .....                          | –0.5V to 7.0V |
| DC Output Voltage $V_{OUT}$ .....                       | –0.5V to 7.0V |
| DC Input Voltage $V_{IN}$ .....                         | –0.5V to 7.0V |
| AC Input Voltage (for a pulse width $\leq 20$ ns) ..... | –3.0V         |
| DC Input Diode Current with $V_{IN} < 0$ .....          | –20mA         |
| DC Output Diode Current with $V_{OUT} < 0$ .....        | –50mA         |
| DC Output Current Max. Sink Current/Pin .....           | 120mA         |
| Maximum Power Dissipation .....                         | 0.5 watts     |
| $T_{STG}$ Storage Temperature .....                     | –65° to 150°C |

**Note:** Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to QSI devices that result in functional or reliability type failures.

**Table 4. Capacitance<sup>(1)</sup>**

$T_A = 25^\circ\text{C}$ ,  $f = 1\text{MHz}$ ,  $V_{IN} = 0\text{V}$ ,  $V_{OUT} = 0\text{V}$

| Pins <sup>(2)</sup>      | SOIC | QSOP | PDIP | ZIP | Unit |
|--------------------------|------|------|------|-----|------|
| 1-3, 5, 6, 10, 11, 13-15 | 4    | 4    | 5    | 7   | pF   |
| 4, 7, 9, 12              | 8    | 8    | 9    | 10  | pF   |

**Notes:**

1. Capacitance is characterized but not tested.
2. Pin reference for 16-pin package.

**Table 5. Power Supply Characteristics**

| Symbol          | Parameter                           | Test Conditions <sup>(1)</sup>                                                                                                             | Min | Max  | Unit       |
|-----------------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-----|------|------------|
| $I_{CC}$        | Quiescent Power Supply Current      | $V_{CC} = \text{Max.}$ , freq = 0<br>$0\text{V} \leq V_{IN} \leq 0.2\text{V}$ or $V_{CC} - 0.2\text{V} \leq V_{IN} \leq V_{CC}$            | —   | 1.5  | mA         |
| $\Delta I_{CC}$ | Supply Current per Input @ TTL HIGH | $V_{CC} = \text{Max.}$ , $V_{IN} = 3.4\text{V}$ , freq = 0 <sup>(2)</sup>                                                                  | —   | 2.0  | mA         |
| $Q_{CCD}$       | Supply Current per Input per MHz    | $V_{CC} = \text{Max.}$ , Outputs Open and Enabled<br>One Bit Toggling @ 50% Duty Cycle<br>Other Inputs at GND or $V_{CC}$ <sup>(3,4)</sup> | —   | 0.25 | mA/<br>MHz |

**Notes:**

1. For conditions shown as Min. or Max., use the appropriate values specified under DC specifications.
2. Per TTL driven input ( $V_{IN} = 3.4\text{V}$ ).
3. For flip-flops,  $Q_{CCD}$  is measured by switching one of the data input pins so that the output changes every clock cycle. This is a measurement of device power consumption only and does not include power to drive load capacitance or tester capacitance. This parameter is guaranteed by design but not tested.
4.  $I_C$  can be computed using the above parameters as explained in the Technical Overview section.

**Table 6. DC Electrical Characteristics Over Operating Range**

Industrial  $T_A = -40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 5\%$

Military  $T_A = -55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 10\%$

| Symbol                   | Parameter                                         | Test Conditions                                                                          | Min        | Typ <sup>(1)</sup> | Max          | Unit          |
|--------------------------|---------------------------------------------------|------------------------------------------------------------------------------------------|------------|--------------------|--------------|---------------|
| $V_{IH}$                 | Input HIGH Voltage                                | Logic HIGH for All Inputs                                                                | 2.0        | —                  | —            | V             |
| $V_{IL}$                 | Input LOW Voltage                                 | Logic LOW for All Inputs                                                                 | —          | —                  | 0.8          | V             |
| $\Delta V_T$             | Input Hysteresis                                  | $V_{TLH} - V_{THL}$ for All Inputs                                                       | —          | 0.2                | —            | V             |
| $ I_{IH} $<br>$ I_{IL} $ | Input Current<br>Input HIGH or LOW                | $V_{CC} = \text{Max.}, 0 \leq V_{IN} < V_{CC}$                                           | —          | —                  | 5            | $\mu\text{A}$ |
| $ I_{OZ} $               | Off-State Output<br>Current (Hi-Z)<br>(257, 2257) | $V_{CC} = \text{Max.}, 0 \leq V_{IN} \leq V_{CC}$                                        | —          | —                  | 5            | $\mu\text{A}$ |
| $I_{OS}$                 | Short Circuit Current<br>(FCTXXX)                 | $V_{CC} = \text{Max.}, V_{OUT} = \text{GND}^{(2,3)}$                                     | -60        | —                  | —            | mA            |
| $I_{OR}$                 | Current Drive<br>(FCT2XXX)                        | $V_{CC} = \text{Max.}, V_{OUT} = 2.0\text{V}^{(3)}$                                      | 50         | —                  | —            | mA            |
| $V_{IC}$                 | Input Clamp Voltage                               | $V_{CC} = \text{Min.}, I_{IN} = -18\text{mA}, T_A = 25^{\circ}\text{C}^{(3)}$            | —          | -0.7               | -1.2         | V             |
| $V_{OH}$                 | Output HIGH Voltage                               | $V_{CC} = \text{Min.}$<br>$I_{OH} = -12\text{mA}$ (MIL)<br>$I_{OH} = -15\text{mA}$ (IND) | 2.4<br>2.4 | —<br>—             | —<br>—       | V             |
| $V_{OL}$                 | Output LOW Voltage<br>(FCTXXX)                    | $V_{CC} = \text{Min.}$<br>$I_{OL} = 32\text{mA}$ (MIL)<br>$I_{OL} = 48\text{mA}$ (IND)   | —<br>—     | —<br>—             | 0.50<br>0.50 | V             |
| $V_{OL}$                 | Output LOW Voltage<br>(FCT2XXX- 25 $\Omega$ )     | $V_{CC} = \text{Min.}$<br>$I_{OL} = 12\text{mA}$ (MIL)<br>$I_{OL} = 12\text{mA}$ (IND)   | —<br>—     | —<br>—             | 0.50<br>0.50 | V             |
| $R_{OUT}$                | Output Resistance<br>(FCT2XXX- 25 $\Omega$ )      | $V_{CC} = \text{Min.}$<br>$I_{OL} = 12\text{mA}$ (MIL)<br>$I_{OL} = 12\text{mA}$ (IND)   | —<br>20    | 25<br>28           | —<br>40      | $\Omega$      |

**Notes:**

1. Typical values indicate  $V_{CC} = 5.0\text{V}$  and  $T_A = 25^{\circ}\text{C}$ .
2. Not more than one output should be shorted and the duration is  $\leq 1$  second.
3. These parameters are guaranteed by design but not tested.

**Table 7. Switching Characteristics Over Operating Range**

Industrial  $T_A = -40^\circ\text{C}$  to  $85^\circ\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 5\%$

Military  $T_A = -55^\circ\text{C}$  to  $125^\circ\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 10\%$

$C_{LOAD} = 50\text{pF}$ ,  $R_{LOAD} = 500\Omega$  unless otherwise noted.

| Symbol                 | Description <sup>(1)</sup>                       |                                          | 2257       |            | 157/8A<br>257A<br>2157A<br>2257A |            | 157/8C<br>257C<br>2157C<br>2257C |            | Unit |
|------------------------|--------------------------------------------------|------------------------------------------|------------|------------|----------------------------------|------------|----------------------------------|------------|------|
|                        |                                                  |                                          | Min        | Max        | Min                              | Max        | Min                              | Max        |      |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>In to Y, 157/8/257          | Ind<br>Mil                               | 1.5<br>1.5 | 6.0<br>7.0 | 1.5<br>1.5                       | 5.0<br>5.8 | 1.5<br>1.5                       | 4.3<br>5.0 | ns   |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>In to Y, 2157/2257          | Ind<br>Mil                               | 1.5<br>1.5 | 6.0<br>7.0 | 1.5<br>1.5                       | 5.0<br>5.8 | 1.5<br>1.5                       | 4.3<br>5.0 | ns   |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>S to Y, 157/8/257           | Ind<br>Mil                               | 1.5<br>1.5 | 10.5<br>12 | 1.5<br>1.5                       | 7.0<br>8.1 | 1.5<br>1.5                       | 5.2<br>6.0 | ns   |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>S to Y, 2157/2257           | Ind<br>Mil                               | 1.5<br>1.5 | 10.5<br>12 | 1.5<br>1.5                       | 7.0<br>8.1 | 1.5<br>1.5                       | 5.2<br>6.0 | ns   |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>$\bar{E}$ to Yi, 157/8      | Ind<br>Mil                               | 1.5<br>1.5 | 10.5<br>12 | 1.5<br>1.5                       | 6.0<br>7.4 | 1.5<br>1.5                       | 4.8<br>5.9 | ns   |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>$\bar{E}$ to Yi, 2157       | Ind<br>Mil                               | 1.5<br>1.5 | 10.5<br>12 | 1.5<br>1.5                       | 6.0<br>7.4 | 1.5<br>1.5                       | 4.8<br>5.9 | ns   |
| $t_{PZH}$<br>$t_{PZL}$ | Output Enable Time<br>$\bar{E}$ to Yi, 257       | Ind<br>Mil                               | 1.5<br>1.5 | 8.5<br>10  | 1.5<br>1.5                       | 7.0<br>8.0 | 1.5<br>1.5                       | 6.0<br>6.8 | ns   |
| $t_{PZH}$<br>$t_{PZL}$ | Output Enable Time<br>$\bar{E}$ to Yi, 2257      | Ind<br>Mil                               | 1.5<br>1.5 | 8.5<br>10  | 1.5<br>1.5                       | 7.0<br>8.0 | 1.5<br>1.5                       | 6.0<br>6.8 | ns   |
| $t_{PHZ}$<br>$t_{PLZ}$ | Output Disable Time<br>$\bar{E}$ to Yi, 257/2257 | Ind <sup>(2)</sup><br>Mil <sup>(2)</sup> | 1.5<br>1.5 | 6.0<br>8.0 | 1.5<br>1.5                       | 5.5<br>5.8 | 1.5<br>1.5                       | 5.0<br>5.3 | ns   |

**Notes:**

1. Minimums guaranteed but not tested.
2. This parameter is guaranteed by design but not tested.
3. See Test Circuit and Waveforms.