# QUICKSWITCH® PRODUCTS HIGH-SPEED CMOS QUICKSWITCH 8:1 MUX/DEMUX

**IDTQS3251**

## FEATURES:

- Enhanced N channel FET with no inherent diode to Vcc
- 5Ω bidirectional switches connect inputs to outputs
- Pin compatible with the 74F251, 74FCT251, and 74FCT251T
- Zero propagation delay, zero ground bounce
- Undershoot clamp diodes on all switch and control inputs
- TTL-compatible control inputs
- Available in SOIC and QSOP packages

## APPLICATIONS:

- Logic replacement
- Video, audio, graphics switching, muxing
- Hot-swapping, hot-docking
- Voltage translation (5V to 3.3V)

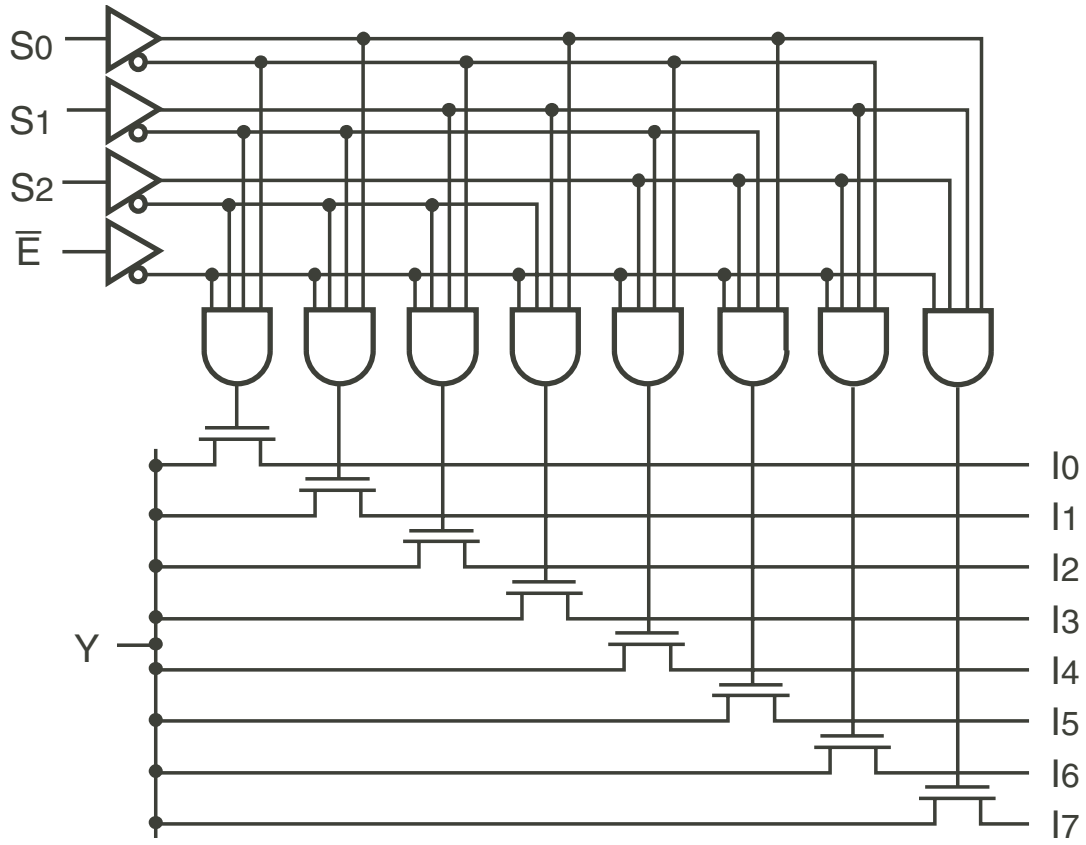
## DESCRIPTION:

The QS3251 is a high-speed CMOS TTL-compatible 8:1 multiplexer/demultiplexer. The QS3251 has 3-state outputs. The QS3251 is a function and pinout compatible version of the 74F251, 74FCT251 and the 74ALS/AS/LS251 8:1 multiplexers. The low ON resistance of the QS3251 allows inputs to be connected to outputs without adding propagation delay and without generating additional ground bounce noise.

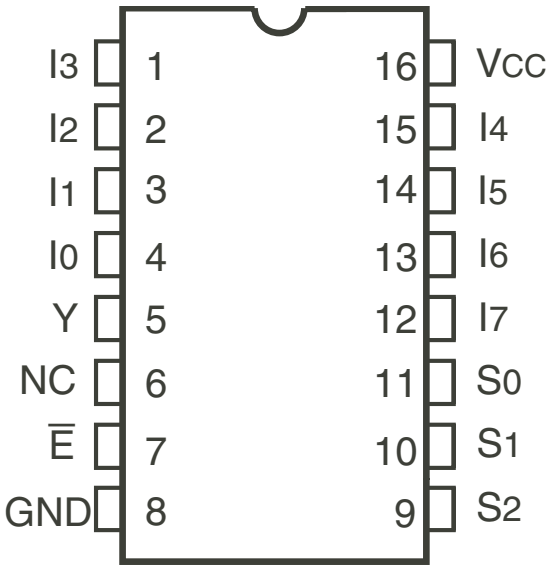
Mux/Demux devices provide an order of magnitude faster speed than equivalent logic devices.

The QS3251 is characterized for operation at -40°C to +85°C.

## FUNCTIONAL BLOCK DIAGRAM



## PIN CONFIGURATION




**SOIC/ QSOP**
**TOP VIEW**

## PIN DESCRIPTION

| Pin Names | I/O | Description |
|---|---|---|
| $I_0$ - $I_7$ | I | Data Inputs |
| $S_0$ - $S_2$ | I | Select Inputs |
| $\overline{E}$ | I | Enable Input |
| Y | O | Data Output |

## ABSOLUTE MAXIMUM RATINGS(1)

| Symbol | Description | Max | Unit |
|---|---|---|---|
| $V_{TERM}$(2) | Supply Voltage to Ground | –0.5 to +7 | V |
| $V_{TERM}$(3) | DC Switch Voltage Vs | –0.5 to +7 | V |
| $V_{TERM}$(3) | DC Input Voltage $V_{IN}$ | –0.5 to +7 | V |
| $V_{AC}$ | AC Input Voltage (pulse width ≤ 20ns) | –3 | V |
| $I_{OUT}$ | DC Output Current | 120 | mA |
| $P_{MAX}$ | Maximum Power Dissipation ($T_A$ = 85°C) | 0.5 | W |
| $T_{STG}$ | Storage Temperature | –65 to +150 | °C |

**NOTE:**
1. Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.
2. Vcc terminals.
3. All terminals except Vcc.

## CAPACITANCE ($T_A$ = +25°C, f = 1MHz, $V_{IN}$ = 0V, $V_{OUT}$ = 0V)

| Pins | | Typ. | Max.(1) | Unit |
|---|---|---|---|---|
| Control Inputs | | 4 | 5 | pF |
| Quickswitch Channels (Switch OFF) | Demux | 5 | 7 | pF |
| | Mux | 21 | 23 | |

**NOTE:**
1. This parameter is guaranteed but not production tested.

## FUNCTION TABLE(1)

| $\overline{E}$ | Select $S_2$ | Select $S_1$ | Select $S_0$ | Y | Function |
|---|---|---|---|---|---|
| H | X | X | X | Hi-Z | Disable |
| L | L | L | L | $I_0$ | $S_2$ - $S_0$ = 0 |
| L | L | L | H | $I_1$ | $S_2$ - $S_0$ = 1 |
| L | L | H | L | $I_2$ | $S_2$ - $S_0$ = 2 |
| L | L | H | H | $I_3$ | $S_2$ - $S_0$ = 3 |
| L | H | L | L | $I_4$ | $S_2$ - $S_0$ = 4 |
| L | H | L | H | $I_5$ | $S_2$ - $S_0$ = 5 |
| L | H | H | L | $I_6$ | $S_2$ - $S_0$ = 6 |
| L | H | H | H | $I_7$ | $S_2$ - $S_0$ = 7 |

**NOTE:**
1. H = HIGH Voltage Level
   L = LOW Voltage Level
   X = Don't Care
   Z = High-Impedence

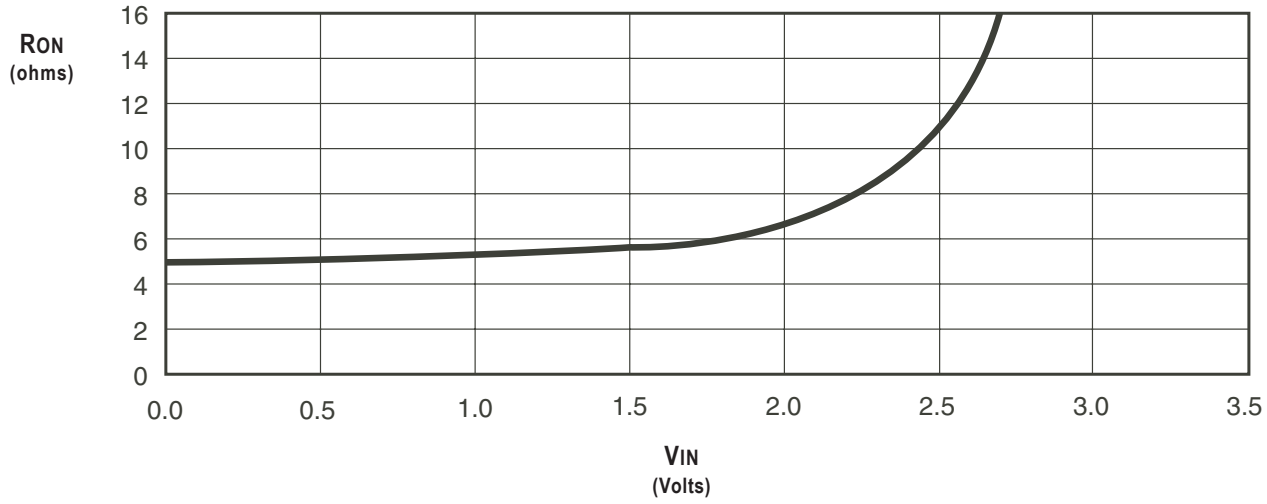
## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:
Industrial: $T_A$ = –40°C to +85°C, $V_{CC}$ = 5.0V ±5%

| Symbol | Parameter | Test Conditions | Min. | Typ.[1] | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{IH}$ | Input HIGH Level | Guaranteed Logic HIGH for Control Pins | 2 | — | — | V |
| $V_{IL}$ | Input LOW Level | Guaranteed Logic LOW for Control Pins | — | — | 0.8 | V |
| $I_{IN}$ | Input LeakageCurrent (Control Inputs) | $0V \le V_{IN} \le V_{CC}$ | — | — | ±1 | µA |
| $I_{OZ}$ | Off-State Output Current (Hi-Z) | $0V \le V_{OUT} \le V_{CC}$ | — | — | ±1 | µA |
| $R_{ON}$ | Switch ON Resistance[2] | $V_{CC}$ = Min., $V_{IN}$ = 0V, $I_{ON}$ = 30mA | — | 5 | 7 | Ω |
| | | $V_{CC}$ = Min., $V_{IN}$ = 2.4V, $I_{ON}$ =15mA | — | 10 | 15 | |
| $V_P$ | Pass Voltage[3] | $V_{IN} = V_{CC}$ = 5V, $I_{OUT}$ = -5µA | 3.7 | 4 | 4.2 | V |

**NOTES:**
1. Typical values are at $V_{CC}$ = 5.0V, $T_A$ = 25°C.
2. $R_{ON}$ is guaranteed but not production tested.
3. Pass Voltage is guaranteed but not production tested.

## TYPICAL ON RESISTANCE vs $V_{IN}$ AT $V_{CC}$ = 5V



## POWER SUPPLY CHARACTERISTICS

| Symbol | Parameter | Test Conditions[1] | Max. | Unit |
|---|---|---|---|---|
| $I_{CCQ}$ | Quiescent Power Supply Current | $V_{CC}$ = Max., $V_{IN}$ = GND or Vcc, f = 0 | 3 | µA |
| $\Delta I_{CC}$ | Power Supply Current per Control Input HIGH [2] | $V_{CC}$ = Max., $V_{IN}$ = 3.4V, f = 0 | 1.5 | mA |
| $I_{CCD}$ | Dynamic Power Supply Current per MHz[3] | $V_{CC}$ = Max., I and Y pins open<br>Control Inputs Toggling at 50% Duty Cycle | 0.25 | mA/MHz |

**NOTES:**
1. For conditions shown as Min. or Max., use the appropriate values specified under DC Electrical Characteristics.
2. Per TLL driven input ($V_{IN}$ = 3.4V, control inputs only). I and Y pins do not contribute to $\Delta I_{CC}$.
3. This current applies to the control inputs only and represents the current required to switch internal capacitance at the specified frequency. The I and Y inputs generate no significant AC or DC currents as they transition. This parameter is guaranteed but not production tested.

## SWITCHING CHARACTERISTICS OVER OPERATING RANGE

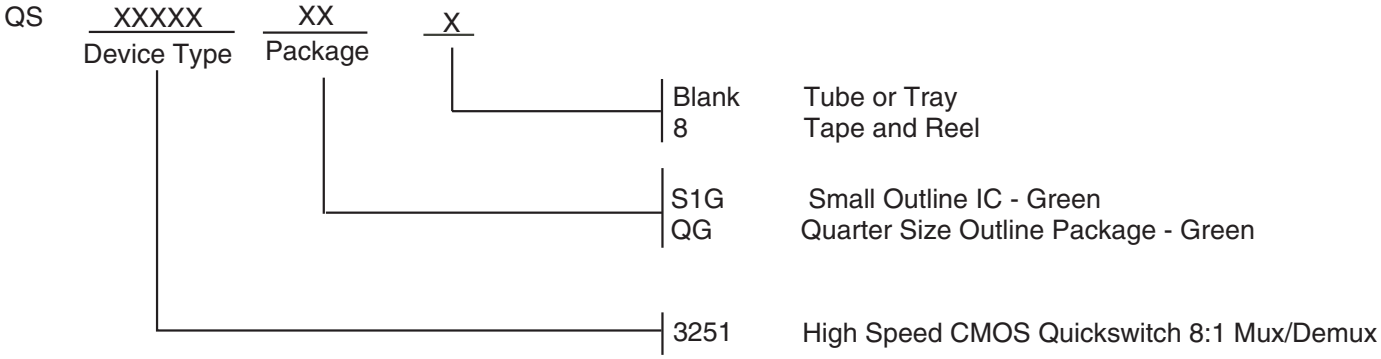
$T_A$ = -40°C to +85°C, $V_{CC}$ = 5.0V ± 5%;

$C_{LOAD}$ = 50pF, $R_{LOAD}$ = 500Ω unless otherwise noted.

| Symbol | Parameter | Min.[1] | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| $t_{PLH}$<br>$t_{PHL}$ | Data Propagation Delay[2,3]<br>Ix to Y | — | — | 0.25 | ns |
| $t_{PZL}$<br>$t_{PZH}$ | Switch Turn-on Delay<br>Sx to Y | 0.5 | — | 6.6 | ns |
| $t_{PZL}$<br>$t_{PZH}$ | Switch Turn-on Delay<br>$\overline{E}$ to Y | 0.5 | — | 6 | ns |
| $t_{PLZ}$<br>$t_{PHZ}$ | Switch Turn-off Delay[2]<br>$\overline{E}$ to Y, Sx to Y | 0.5 | — | 6 | ns |

**NOTES:**
1. Minimums are guaranteed but not production tested.
2. This parameter is guaranteed but not production tested.
3. The bus switch contributes no propagation delay other than the RC delay of the ON resistance of the switch and the load capacitance. The time constant for the switch alone is of the order of 0.25ns for $C_L$ = 50pF. Since this time constant is much smaller than the rise and fall times of typical driving signals, it adds very little propagation delay to the system. Propagation delay of the bus switch, when used in a system, is determined by the driving circuit on the driving side of the switch and its interaction with the load on the driven side.

## ORDERING INFORMATION




## Datasheet Document History

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|---|---|---|
| 02/14/2011 | Pg. 5 | Updated the ordering information by removing the "IDT" notation, non RoHS part and by adding Tape and Reel information. |