



**QUICKSWITCH® PRODUCTS**  
**HIGH-SPEED CMOS**  
**QUICKSWITCH MULTIWIDTH™**  
**24:6 MUX/DEMUX**

**IDTQS33X253**

**FEATURES:**

- Enhanced N channel FET with no inherent diode to Vcc
- Bidirectional switches connect inputs to outputs
- 24:6 Mux/Demux switches
- Zero propagation delay, zero ground bounce
- Individual controls for each bank
- Undershoot clamp diodes on all switch and control pins
- TTL-compatible control inputs
- Available in 48-pin QVSOP Package

**APPLICATIONS**

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

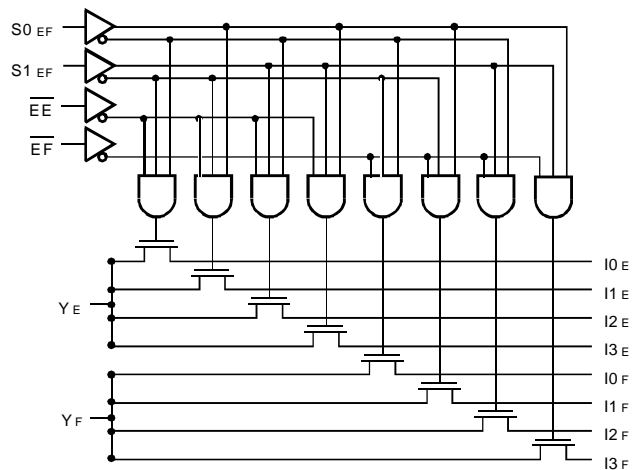
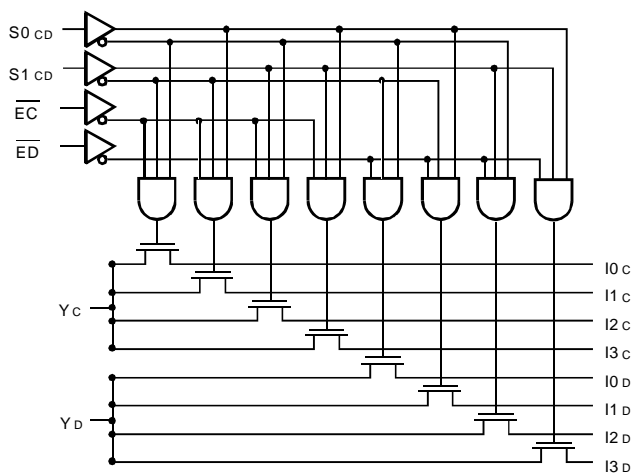
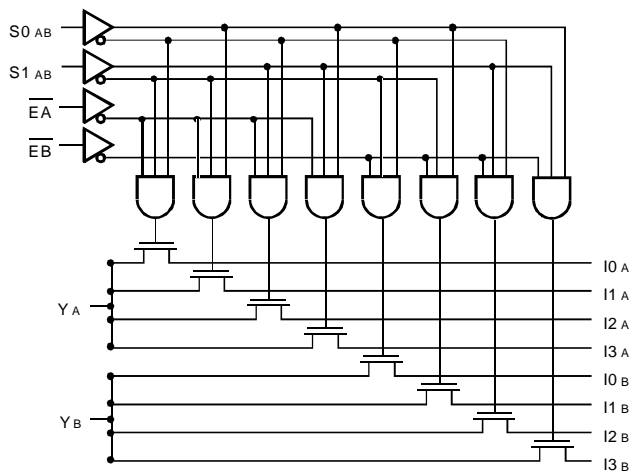
**DESCRIPTION:**

The QS33X253 is a high-speed CMOS 24:6 (3, dual 4:1) multiplexer/demultiplexer. The QS33X253 is a member of the MultiWidth™ family and is functionally compatible to three of the QuickSwitch version of the 74F253, 74FCT253, and the 74ALS/AS/LS253 Dual 4:1 multiplexers. The low ON resistance of the QS33X253 allows inputs to be connected to outputs without adding propagation delay and without generating additional ground bounce noise. TTL-compatible control circuitry with "Break-before-make" feature avoids bus contention on the demux side. This part is ideal for video switching and four way memory bank interleaving applications.

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

The QS33X253 is characterized for operation at -40°C to +85°C.

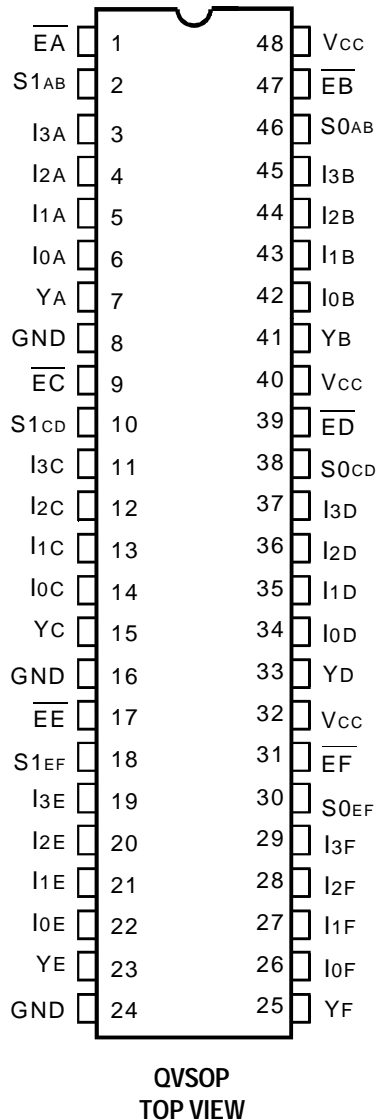
**FUNCTIONAL BLOCK DIAGRAM**



**INDUSTRIAL TEMPERATURE RANGE**

**JANUARY 2000**

## PIN CONFIGURATION



## PIN DESCRIPTION

| Pin Names       | I/O | Description   |
|-----------------|-----|---------------|
| Ixx             | I   | Data Inputs   |
| S0xx, S1xx      | I   | Select Inputs |
| $\overline{E}x$ | I   | Enable Inputs |
| Yx              | O   | Data Outputs  |

## 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 $V_s$                          | - 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 $\leq 20ns$ )      | -3           | V          |
| $I_{OUT}$        | DC Output Current                                | 120          | mA         |
| $P_{MAX}$        | Maximum Power Dissipation ( $T_A = 85^\circ C$ ) | .5           | W          |
| $T_{STG}$        | Storage Temperature                              | - 65 to +150 | $^\circ C$ |

### NOTES:

- 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.
- $V_{CC}$  Terminals.
- All terminals except  $V_{CC}$ .

## CAPACITANCE

( $T_A = +25^\circ C$ ,  $f = 1.0MHz$ ,  $V_{IN} = 0V$ ,  $V_{OUT} = 0V$ )

| Pins                 |       | Typ. | Max. (1) | Unit |
|----------------------|-------|------|----------|------|
| Control Inputs       |       | 4    | 5        | pF   |
| Quickswitch Channels | Demux | 5    | 7        | pF   |
| (Switch OFF)         | Mux   | 14   | 16       | pF   |

### NOTE:

- This parameter is guaranteed at characterization but not tested.

## FUNCTION TABLE (1, 2)

| Enable          |                 | Select |      | Outputs |      | Function      |
|-----------------|-----------------|--------|------|---------|------|---------------|
| $\overline{E}A$ | $\overline{E}B$ | S1AB   | S0AB | YA      | YB   |               |
| H               | X               | X      | X    | Hi-Z    | X    | Disable A     |
| X               | H               | X      | X    | X       | Hi-Z | Disable B     |
| L               | L               | L      | L    | I0A     | I0B  | $S_1 - 0 = 0$ |
| L               | L               | L      | H    | I1A     | I1B  | $S_1 - 0 = 1$ |
| L               | L               | H      | L    | I2A     | I2B  | $S_1 - 0 = 2$ |
| L               | L               | H      | H    | I3A     | I3B  | $S_1 - 0 = 3$ |

### NOTES:

- H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Don't Care  
Z = High-Impedence
- This table represents the function for block "AB".  
The "CD" block nomenclature substitutes "A" for "C" and "B" for "D".  
The "EF" block nomenclature substitutes "A" for "E" and "B" for "F".

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

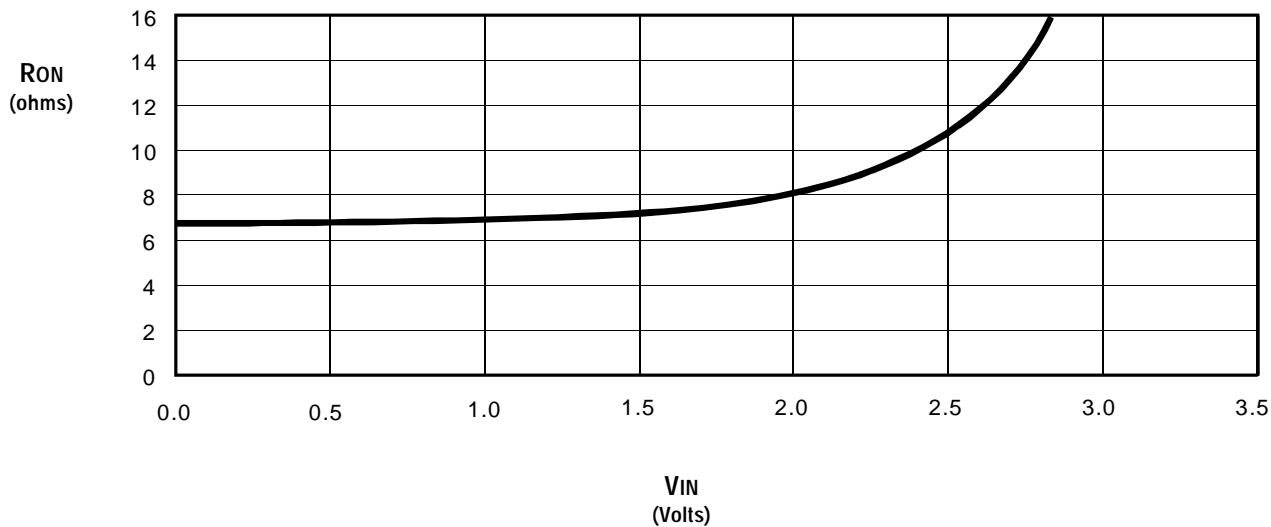
Industrial:  $T_A = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 5\%$

| Symbol   | Parameter                              | Test Conditions  | Min. | Typ. <sup>(1)</sup> | Max.    | Unit          |
|----------|--|--|------|---------------------|---------|---------------|
| $V_{IH}$ | Input HIGH Voltage                     | Guaranteed Logic HIGH for Control Inputs                           | 2    | —                   | —       | V             |
| $V_{IL}$ | Input LOW Voltage                      | Guaranteed Logic LOW for Control Inputs                            | —    | —                   | 0.8     | V             |
| $I_{IN}$ | Input Leakage Current (Control Inputs) | $0\text{V} \leq V_{IN} \leq V_{CC}$                                | —    | —                   | $\pm 1$ | $\mu\text{A}$ |
| $I_{OZ}$ | Off-State Current (Hi-Z)               | $0\text{V} \leq V_{OUT} \leq V_{CC}$                               | —    | —                   | $\pm 1$ | $\mu\text{A}$ |
| $R_{ON}$ | Switch ON Resistance                   | $V_{CC} = \text{Min.}, V_{IN} = 0\text{V}, I_{ON} = 30\text{mA}$   | —    | 7                   | 10      | $\Omega$      |
| $R_{ON}$ | Switch ON Resistance                   | $V_{CC} = \text{Min.}, V_{IN} = 2.4\text{V}, I_{ON} = 15\text{mA}$ | —    | 10                  | 15      | $\Omega$      |
| $V_P$    | Pass Voltage <sup>(2)</sup>            | $V_{IN} = V_{CC} = 5\text{V}, I_{OUT} = -5\mu\text{A}$             | 3.7  | 4                   | 4.2     | V             |

**NOTES:**

1. Typical values are at  $V_{CC} = 5.0\text{V}$ ,  $T_A = 25^{\circ}\text{C}$ .
2. Pass voltage is guaranteed but not production tested.

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



## POWER SUPPLY CHARACTERISTICS

| Symbol           | Parameter  | Test Conditions <sup>(1)</sup>  | Max. | Unit   |
|------------------|--|---|------|--------|
| I <sub>CCQ</sub> | Quiescent Power Supply Current                             | V <sub>CC</sub> = Max., V <sub>IN</sub> = GND or V <sub>CC</sub> , f = 0              | 9    | μA     |
| ΔI <sub>CC</sub> | Power Supply Current per Control Input HIGH <sup>(2)</sup> | V <sub>CC</sub> = Max., V <sub>IN</sub> = 3.4V, f = 0                                 | 1.5  | mA     |
| I <sub>CCD</sub> | Dynamic Power Supply Current per MHz <sup>(3)</sup>        | V <sub>CC</sub> = Max., I and Y pins open<br>Control Input Toggling at 50% Duty Cycle | 0.25 | mA/MHz |

### NOTES:

- For conditions shown as Min. or Max., use the appropriate values specified under DC Electrical Characteristics.
- Per TTL driven input (V<sub>IN</sub> = 3.4V, control inputs only). I and Y pins do not contribute to ΔI<sub>CC</sub>.
- 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<sub>A</sub> = -40°C to +85°C, V<sub>CC</sub> = 5.0V ± 5%

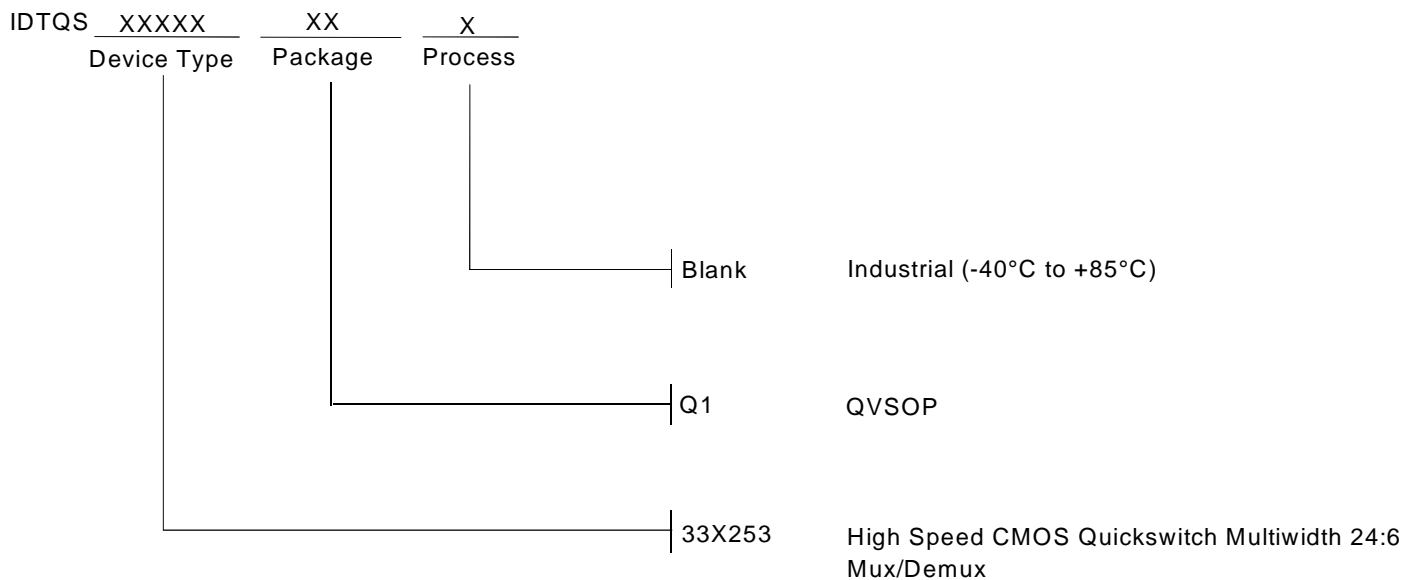
C<sub>LOAD</sub> = 50pF, R<sub>LOAD</sub> = 500Ω unless otherwise noted.

| Symbol                               | Parameter  | Min. <sup>(1)</sup> | Typ. | Max. | Unit |
|--------------------------------------|--|---------------------|------|------|------|
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Data Propagation Delay <sup>(2, 3)</sup><br>In to Y                                | —                   | —    | 0.25 | ns   |
| t <sub>PZL</sub><br>t <sub>PZH</sub> | Switch Turn-On Delay<br>S <sub>n</sub> to Y  | 0.5                 | —    | 6.6  | ns   |
| t <sub>PZL</sub><br>t <sub>PZH</sub> | Switch Turn-Off Delay<br>$\overline{E}_n$ to Y                                     | 0.5                 | —    | 6    | ns   |
| t <sub>PLZ</sub><br>t <sub>PHZ</sub> | Switch Turn-Off Delay <sup>(2)</sup><br>$\overline{E}_n$ to Y, S <sub>n</sub> to Y | 0.5                 | —    | 6    | ns   |

### NOTES:

- Minimums guaranteed but not tested.
- This parameter is guaranteed but not tested.
- 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<sub>L</sub> = 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



**CORPORATE HEADQUARTERS**  
2975 Stender Way  
Santa Clara, CA 95054

**for SALES:**  
800-345-7015 or 408-727-6116  
fax: 408-492-8674  
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