



# QUICKSWITCH® PRODUCTS HIGH-SPEED CMOS QUICKSWITCH 24:12 MUX/DEMUX

IDTQS33X257

## FEATURES:

- Enhanced N channel FET with no inherent diode to Vcc
- Bidirectional signal flow
- 24:12 Mux/Demux switches connect inputs to outputs
- Individual controls for each bank
- Zero propagation delay, zero ground bounce
- Undershoot clamp diodes on all switch and control inputs
- TTL-compatible control inputs
- Available in 48-pin QVSOP package

## APPLICATIONS:

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

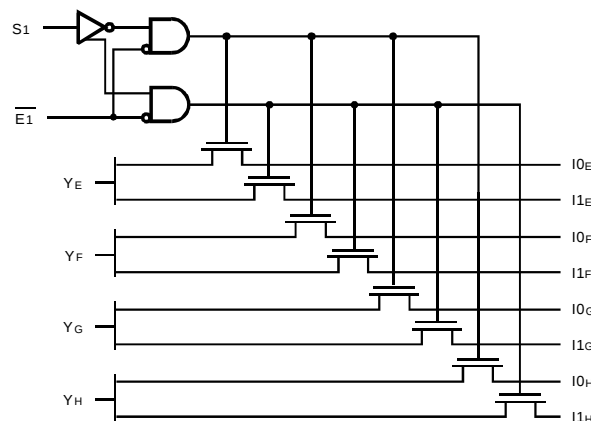
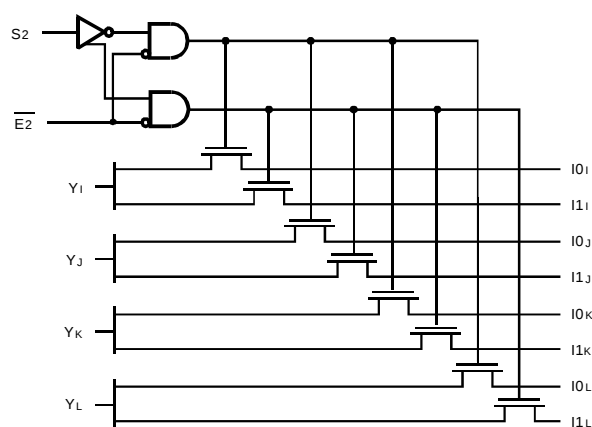
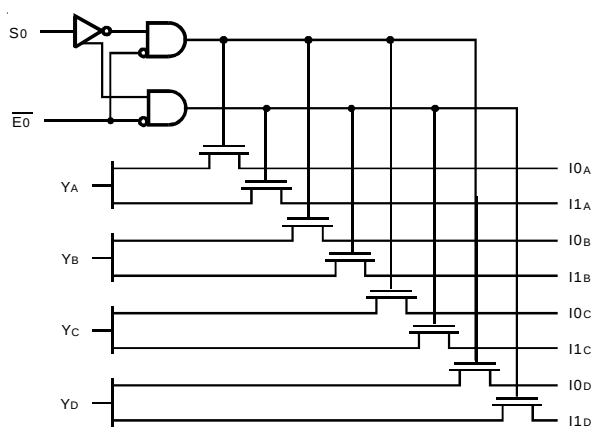
## DESCRIPTION:

The QS33X257 is a high-speed CMOS TTL-compatible 24:12 multiplexer/demultiplexer. The QS33X257 is functionally compatible to three of the QuickSwitch version of the 74F257, 74FCT257, and the 74ALS/AS/LS257 Quad 2:1 multiplexers. The low ON resistance of the QS33X257 allows inputs to be connected to outputs without adding propagation delay and without generating additional ground bounce noise. This part will be used in wide bus multiplexing where board space is at a premium.

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

The QS33X257 is characterized for operation at -40°C to +85°C.

## FUNCTIONAL BLOCK DIAGRAM

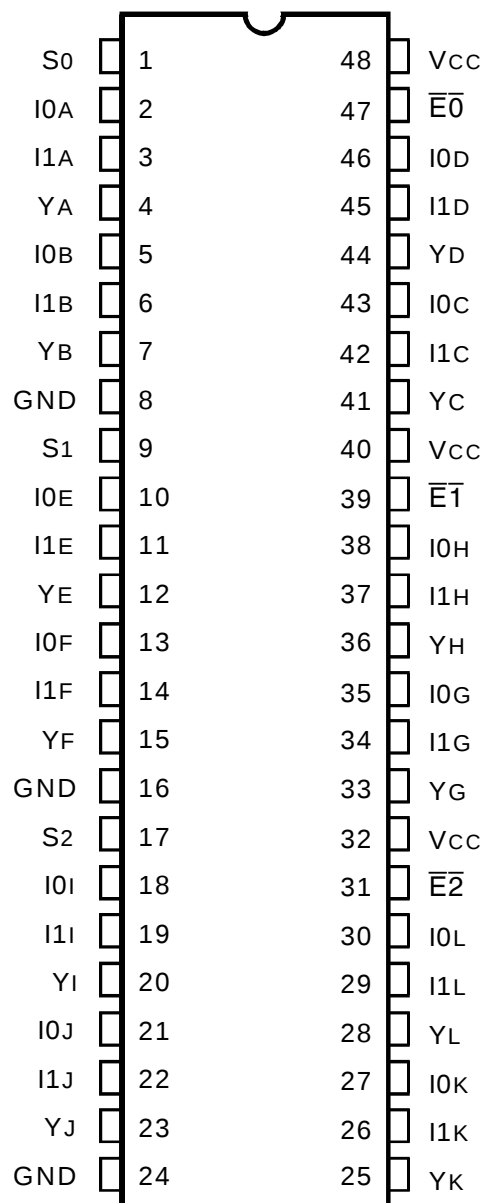


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INDUSTRIAL TEMPERATURE RANGE

MARCH 2000

## PIN CONFIGURATION



QVSOP  
TOP VIEW

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

| Symbol               | Description                             | Max         | Unit |
|----------------------|-----------------------------------------|-------------|------|
| VTERM <sup>(2)</sup> | Supply Voltage to Ground                | -0.5 to +7  | V    |
| VTERM <sup>(3)</sup> | DC Switch Voltage Vs                    | -0.5 to +7  | V    |
| VTERM <sup>(3)</sup> | DC Input Voltage VIN                    | -0.5 to +7  | V    |
| VAC                  | AC Input Voltage (pulse width ≤ 20ns)   | -3          | V    |
| IOUT                 | DC Output Current Max. Sink Current/Pin | 120         | mA   |
| PMAX                 | Maximum Power Dissipation               | 0.5         | W    |
| TSTG                 | Storage Temperature                     | -65 to +150 | °C   |

### NOTE:

- 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.
- Vcc terminals.
- All terminals except Vcc.

## CAPACITANCE

(TA = +25°C, f = 1.0MHz, VIN = 0V, VOUT = 0V)

| Pins                                 | Typ.  | Max. <sup>(1)</sup> | Unit |
|--------------------------------------|-------|---------------------|------|
| Control Pins                         | 4     | 5                   | pF   |
| Quickswitch Channels<br>(Switch OFF) | Demux | 5                   | pF   |
|                                      | Mux   | 9                   |      |

### NOTE:

- This parameter is measured at characterization but not tested.

## PIN DESCRIPTION

| Pin Names | I/O | Description  |
|-----------|-----|--------------|
| Ixx       | I/O | Data Inputs  |
| Sx        | I   | Select Input |
| Ex        | I/O | Enable Input |
| Yx        | I/O | Data Outputs |

## FUNCTION TABLE<sup>(1)</sup>

| Enable |    | Outputs |     |     |     | Function |
|--------|----|---------|-----|-----|-----|----------|
| Ex     | Sx | YA      | YB  | Yc  | YD  |          |
| H      | X  | Z       | Z   | Z   | Z   | Disable  |
| L      | L  | IOA     | IOB | IOc | IOx | Select 0 |
| L      | H  | I1A     | I1B | I1c | I1x | Select 1 |

### NOTE:

- H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Don't Care  
Z = High-Impedance

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

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

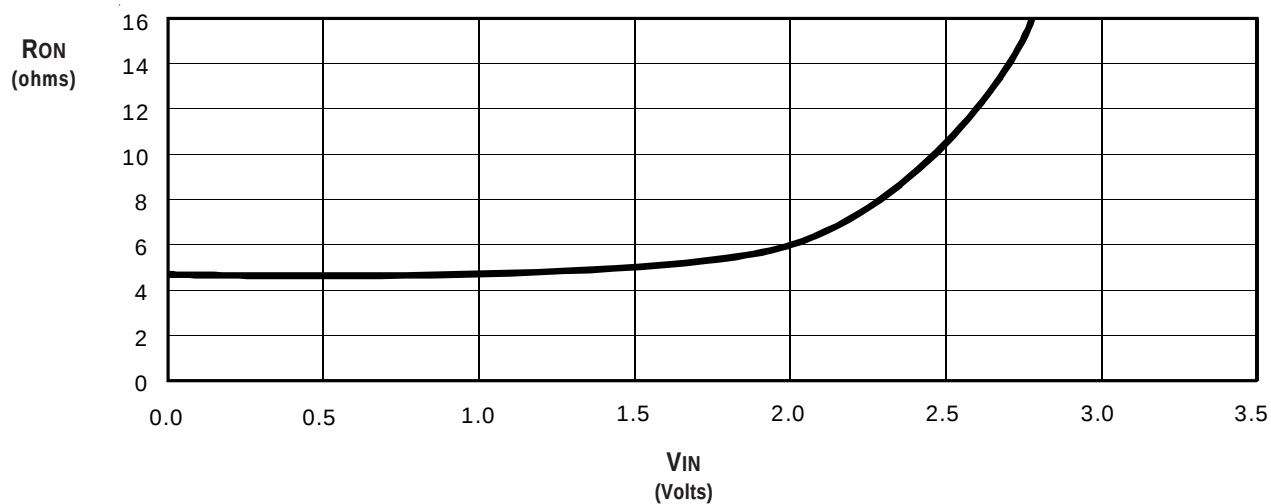
| Symbol   | Parameter                              | Test Conditions                                                    | Min. | Typ. <sup>(1)</sup> | Max.    | Unit          |
|----------|----------------------------------------|--------------------------------------------------------------------|------|---------------------|---------|---------------|
| $V_{IH}$ | Input HIGH 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 Leakage Current (Control Inputs) | $0\text{V} \leq V_{IN} \leq V_{CC}$                                | —    | —                   | $\pm 1$ | $\mu\text{A}$ |
| $I_{OZ}$ | Off-State Output Current (Hi-Z)        | $0\text{V} \leq V_{OUT} \leq V_{CC}$                               | —    | —                   | $\pm 1$ | $\mu\text{A}$ |
| $R_{ON}$ | Switch ON Resistance                   | $V_{CC} = \text{Min.}, V_{IN} = 0\text{V}, I_{ON} = 30\text{mA}$   | —    | 5                   | 7       | $\Omega$      |
|          |                                        | $V_{CC} = \text{Min.}, V_{IN} = 2.4\text{V}, I_{ON} = 15\text{mA}$ | —    | 10                  | 15      |               |
| $V_P$    | 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 Inputs 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 TLL 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> | Data Propagation Delay <sup>(2,3)</sup> | —                   | 0.25 | —    | ns   |
| t <sub>PHL</sub> | Ix to Y                                 | —                   | —    | —    | —    |
| t <sub>PZL</sub> | Switch Turn-on Delay                    | 0.5                 | —    | 5.2  | ns   |
| t <sub>PZH</sub> | Sx to Y                                 | —                   | —    | —    | —    |
| t <sub>PLZ</sub> | Switch Turn-off Delay                   | 0.5                 | —    | 4.8  | ns   |
| t <sub>PHZ</sub> | $\overline{E}x$ to Y                    | —                   | —    | —    | —    |
| t <sub>PLZ</sub> | Switch Turn-off Delay <sup>(2)</sup>    | 0.5                 | —    | 5    | ns   |
| t <sub>PHZ</sub> | $\overline{E}x$ to Y, Sx to Y           | —                   | —    | —    | —    |

### NOTES:

- Minimums are guaranteed but not production tested.
- This parameter is guaranteed but not production 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

| IDTQS       | XXXXX   | XX      | X      |                                             |  |
|-------------|---------|---------|--------|---------------------------------------------|--|
| Device Type | Package | Process |        |                                             |  |
|             |         |         | Blank  | Industrial (-40°C to +85°C)                 |  |
|             |         |         | Q1     | QVSOP                                       |  |
|             |         |         | 33X257 | High Speed CMOS Quickswitch 24:12 Mux/Demux |  |



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