



# QUICKSWITCH® PRODUCTS

## HIGH-SPEED CMOS QUICKSWITCH

### 16:8 MULTIPLEXER

**IDTQS3390**

#### FEATURES:

- Enhanced N channel FET with no inherent diode to Vcc
- 16:8 multiplexer function with zero delay
- 5Ω bidirectional switches connect inputs to outputs
- Zero propagation delay, zero ground bounce
- Low power CMOS proprietary technology
- Undershoot clamp diodes on all switch and control inputs
- Direct bidirectional connection for mux, demux
- Available in SOIC and QSOP packages

#### APPLICATIONS:

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

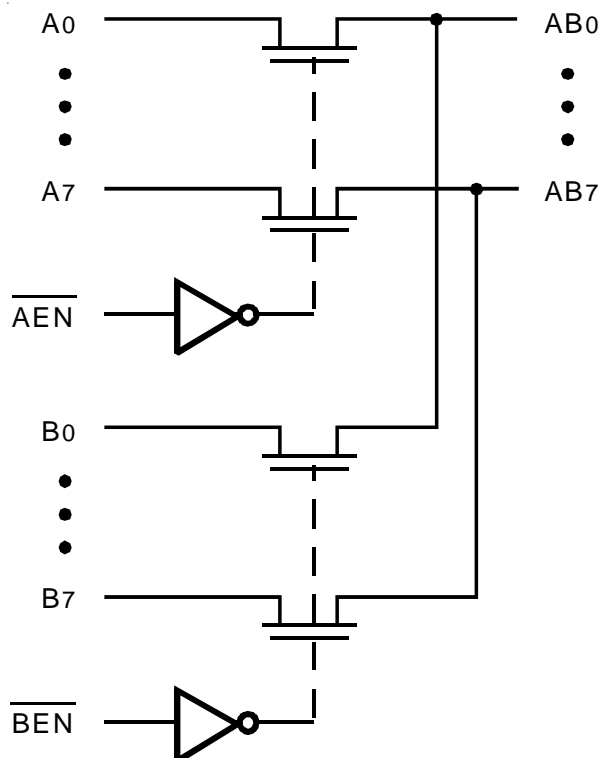
#### DESCRIPTION:

The QS3390 provides a 16:8 multiplexer logic switch. The low ON resistance (5Ω) of the QS3390 allows inputs to be connected to the outputs without adding propagation delay and without generating additional ground bounce noise.

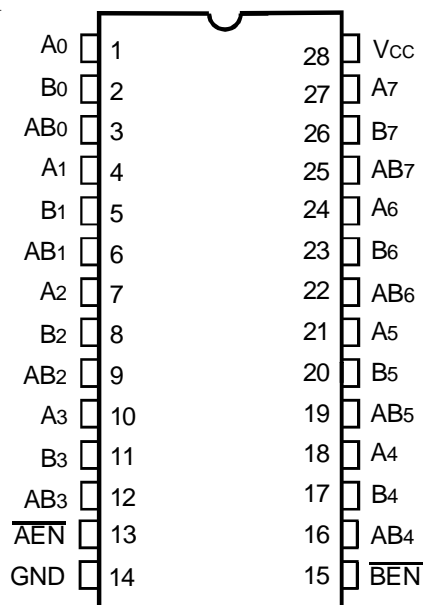
Mux/Demux devices provide an order of magnitude faster speed than equivalent logic devices.

The QS3390 is characterized for operation at -40°C to +85°C.

#### FUNCTIONAL BLOCK DIAGRAM



## PIN CONFIGURATION



SOIC/ QSOP/ TSSOP  
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 V <sub>S</sub>                  | -0.5 to +7  | V    |
| VTERM <sup>(3)</sup> | DC Input Voltage V <sub>IN</sub>                  | -0.5 to +7  | V    |
| V <sub>AC</sub>      | AC Input Voltage (pulse width ≤20ns)              | -3          | V    |
| I <sub>OUT</sub>     | DC Output Current                                 | 120         | mA   |
| P <sub>MAX</sub>     | Maximum Power Dissipation (T <sub>A</sub> = 85°C) | 0.5         | W    |
| T <sub>STG</sub>     | Storage Temperature                               | -65 to +150 | °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<sub>cc</sub> terminals.
- All terminals except V<sub>cc</sub>.

## CAPACITANCE (T<sub>A</sub> = +25°C, f = 1MHz, V<sub>IN</sub> = 0V, V<sub>OUT</sub> = 0V)

| Pins                 |       | Typ. | Max. <sup>(1)</sup> | Unit |
|----------------------|-------|------|---------------------|------|
| Control Inputs       |       | 4    | 5                   | pF   |
| Quickswitch Channels | Demux | 5    | 7                   | pF   |
| (Switch OFF)         | Mux   | 9    | 10                  |      |

### NOTE:

- This parameter is guaranteed but not production tested.

## PIN DESCRIPTION

| Pin Names   | I/O | Description       |
|---|-----|-------------------|
| A <sub>0</sub> - A <sub>9</sub>                   | I/O | Bus A             |
| B <sub>0</sub> - B <sub>9</sub>                   | I/O | Bus B             |
| $\overline{\text{AEN}}$ , $\overline{\text{BEN}}$ | I   | Bus Switch Enable |

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

| $\overline{\text{AEN}}$ | $\overline{\text{BEN}}$ | A <sub>0</sub> - A <sub>9</sub> | B <sub>0</sub> - B <sub>9</sub> | Function   |
|-------------------------|-------------------------|---------------------------------|---------------------------------|------------|
| H                       | H                       | Off                             | Off                             | Disconnect |
| L                       | H                       | On                              | Off                             | A to AB    |
| H                       | L                       | Off                             | On                              | B to AB    |
| L                       | L                       | On                              | On                              | A, B to AB |

### NOTE:

- H = HIGH Voltage Level  
L = LOW Voltage Level

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

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

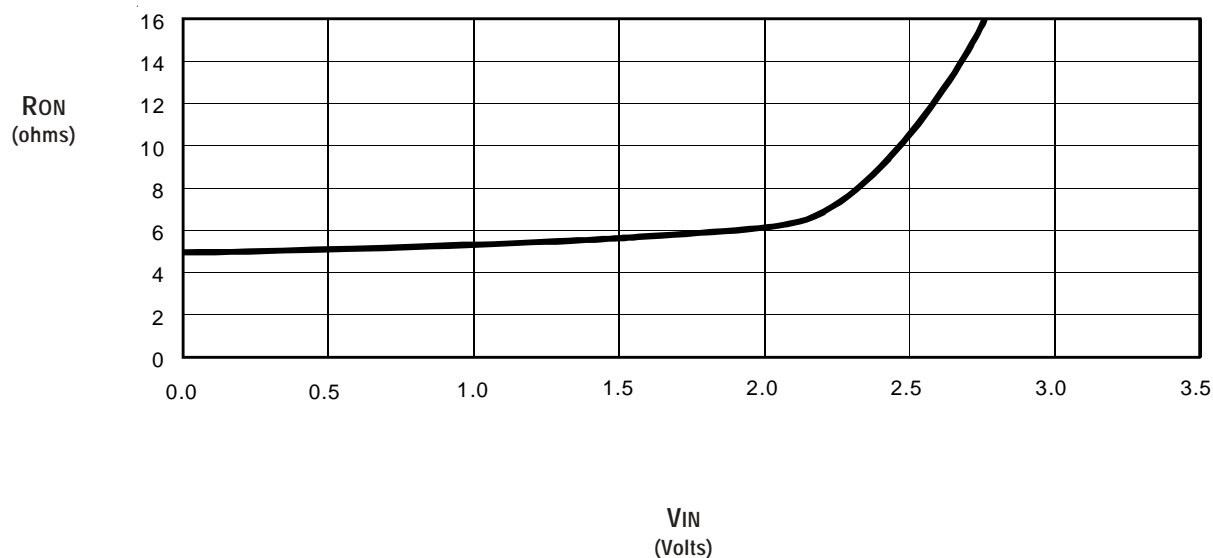
| Symbol   | Parameter                              | Test Conditions  | Min. | Typ. <sup>(1)</sup> | Max.    | Unit          |
|----------|--|--|------|---------------------|---------|---------------|
| $V_{IH}$ | Input HIGH Voltage                     | Guaranteed Logic HIGH for Control Pins                             | 2    | —                   | —       | V             |
| $V_{IL}$ | Input LOW Voltage                      | 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 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  $V_{CC} = 5\text{V}$  and  $T_A = 25^{\circ}\text{C}$ .

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                    | 3    | μA     |
| ΔI <sub>CC</sub> | Power Supply Current per 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., A, B, and AB Pins Open, Control Inputs Toggling<br>@ 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). A, B, and AB 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 A, B, and AB 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> = 5V ± 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)</sup><br>A, B, to/from AB                             | —                   | —    | 0.25 <sup>(3)</sup> | ns   |
| t <sub>PZL</sub><br>t <sub>PZH</sub> | Switch Turn-On Delay<br>A <sub>EN</sub> , B <sub>EN</sub> to A, B, AB                 | 1.5                 | —    | 6.5                 | ns   |
| t <sub>PLZ</sub><br>t <sub>PHZ</sub> | Switch Turn-Off Delay <sup>(2)</sup><br>A <sub>EN</sub> , B <sub>EN</sub> to A, B, AB | 1.5                 | —    | 5.5                 | ns   |

### 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 at 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)                      |  |
|             |         |         | SO<br>Q | Small Outline IC<br>Quarter Size Outline Package |  |
|             |         |         | 3390    | High Speed CMOS QuickSwitch 16:8 Multiplexer     |  |



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