# QUICKSWITCH® PRODUCTS
# 3.3V HIGH SPEED BUS SWITCH

**IDTQS3V245**

## FEATURES:

- **5Ω bi-directional switches connect inputs to outputs**
- **Pin compatibility with QS3245**
- **250ps propagation delay**
- **Undershoot Clamp Diodes on all switch and control Inputs**
- **LVTTL-compatible control Inputs**
- **Available in SOIC and QSOP packages**

## APPLICATIONS:

- **3.3V to 2.5V voltage translation**
- **2.5V to 1.8V voltage translation**
- **PCI bus isolation hot swap**

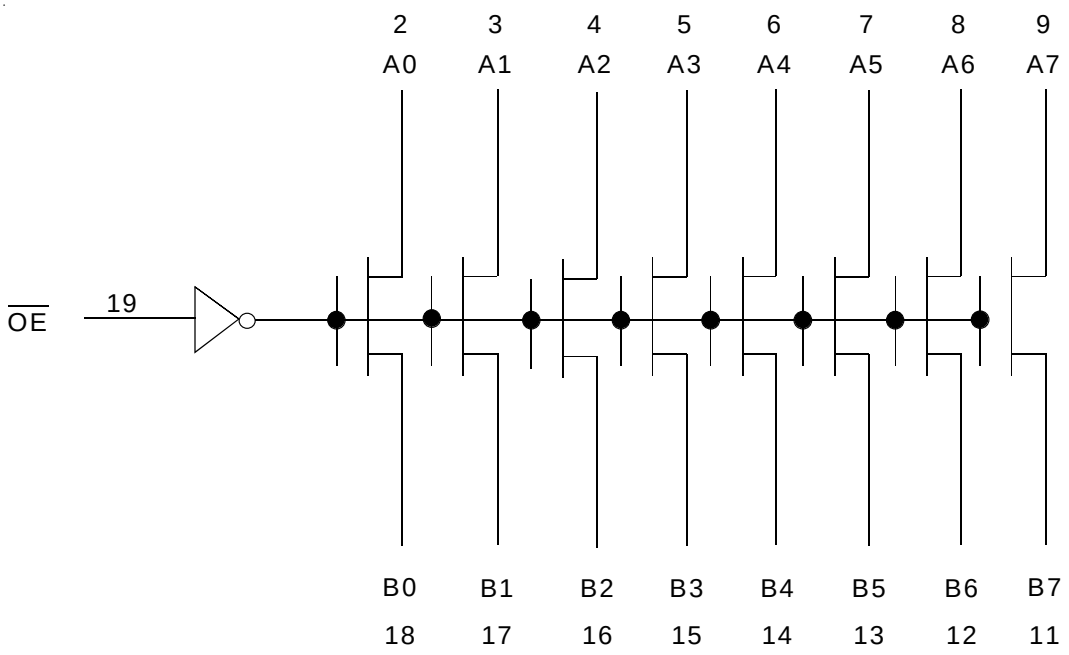
## DESCRIPTION:

The QS3V245 is an 8-bit high speed bus switch controlled by LVTTL-compatible active low enable signal. When closed, the switches exhibit near zero propagation delay without generating additional ground bounce or switching noise.

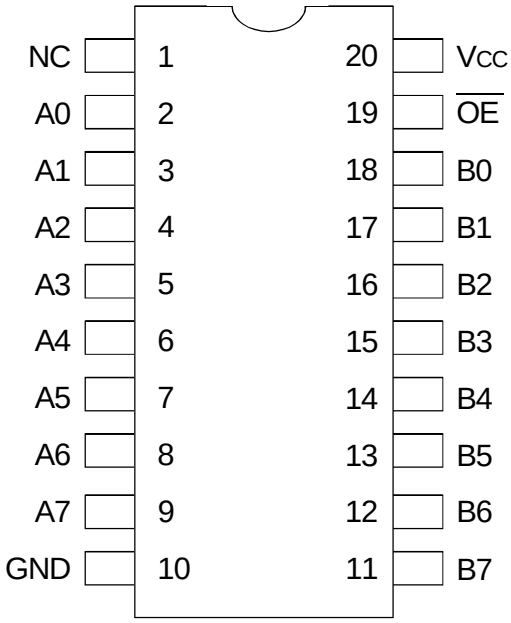
The QS3V245 is specially designed for direct interface between 3.3V and 2.5V devices without any external components. When operating from a 3.3V supply, the logic high level at the switch output is clamped to 2.5V when the switch input signal exceeds 2.5V. This device can be used for switching 2.5V buses without signal attenuation. The ON resistance at 3.3V $V_{CC}$ is less than 5Ω typical, providing near zero propagation delay through the switch. Absence of DC path from switch I/O pins to $V_{CC}$ or ground makes QS3V245 an ideal device for hot swapping applications.

The QS3V245 is characterized for operation from -40°C to +85°C.

## FUNCTIONAL BLOCK DIAGRAM



## PIN CONFIGURATION




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

## ABSOLUTE MAXIMUM RATINGS(1)

| Symbol | Description | Max | Unit |
|---|---|---|---|
| $V_{TERM}$(2) | Supply Voltage to Ground | –0.5 to +4.6 | V |
| $V_S$ | DC Switch Voltage | –0.5 to +4.6 | V |
| $V_{IN}$ | DC Input Voltage | –0.5 to +4.6 | V |
| $V_{AC}$ | AC Input Voltage (pulse width ≤20ns) | –3 | V |
| $I_{OUT}$ | DC Output Current (max. sink current/pin) | 120 | mA |
| | Maximum Power Dissipation | 0.5 | W |
| $T_{STG}$ | Storage Temperature | –65 to +150 | °C |

**NOTES:**
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. $V_{CC}$ terminals.

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

| Symbol | Parameter(1) | Typ. | Max. | Unit |
|---|---|---|---|---|
| $C_{IN}$ | Control Inputs | 4 | 6 | pF |
| $C_{I/O}$ | Quickswitch Channels (Switch OFF) | 5 | 7 | pF |

**NOTE:**
1. As applicable to the device type.

## PIN DESCRIPTION

| Pin Names | Description |
|---|---|
| $\overline{OE}$ | Output Enable |
| Ax | Data I/Os |
| Bx | Data I/Os |

## FUNCTION TABLE(1)

| $\overline{OE}$ | Outputs |
|---|---|
| H | Disconnected |
| L | Ax = Bx |

**NOTE:**
1. H = HIGH Voltage Level
   L = LOW Voltage Level

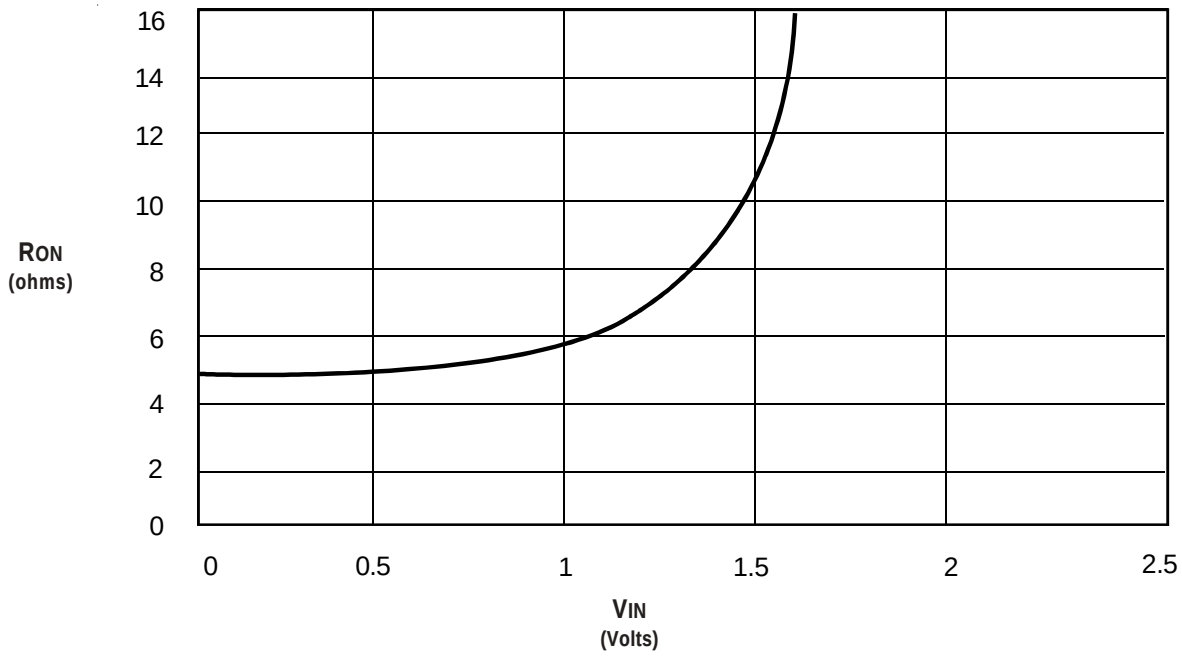
## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:
Industrial: $T_A$ = –40°C to +85°C, $V_{CC}$ = 3.3V ±0.3V

| Symbol | Parameter | Test Conditions | Min. | Typ.[1] | 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) | 0V ≤ $V_{IN}$ ≤ $V_{CC}$ | — | — | 1 | µA |
| $I_{OZ}$ | Off-State Current (Hi-Z) | 0V ≤ $V_{OUT}$ ≤ $V_{CC}$, Switches OFF | — | 0.001 | 1 | µA |
| $R_{ON}$ | Switch ON Resistance | $V_{CC}$ = Min., $V_{IN}$ = 0V, $I_{ON}$ = 8mA | — | 5 | 7 | Ω |
| | | $V_{CC}$ = Min., $V_{IN}$ = 1.7V, $I_{ON}$ = 8mA | — | 15 | 20 | |
| | | $V_{CC}$ = 2.3V, $V_{IN}$ = 0V, $I_{ON}$ = 8mA | — | 7 | — | |
| | | $V_{CC}$ = 2.3V, $V_{IN}$ = 1.3V, $I_{ON}$ = 8mA | — | 25 | — | |
| $V_P$ | Pass Voltage[2] | $V_{IN}$ = $V_{CC}$ = 3.3V, $I_{OUT}$ = -5µA | 2.3 | 2.7 | 2.9 | V |
| | | $V_{IN}$ = $V_{CC}$ = 2.5V, $I_{OUT}$ = -5µA | — | 1.8 | — | |

**NOTES:**
1. Typical values are at $V_{CC}$ = 3.3V and $T_A$ = 25°C.
2. Pass voltage is guaranteed, but not production tested.

## TYPICAL ON RESISTANCE vs $V_{IN}$ AT $V_{CC}$ = 3.3V



## POWER SUPPLY CHARACTERISTICS

$T_A$ = –40°C to +85°C, $V_{CC}$ = 3.3V ±0.3V

| Symbol | Parameter | Test Conditions[1] | Min. | Max. | Unit |
|---|---|---|---|---|---|
| $I_{CCQ}$ | Quiescent Power Supply Current | $V_{CC}$ = Max., $V_{IN}$ = GND or $V_{CC}$, f = 0 | — | 3 | µA |
| $\Delta I_{CC}$ | Power Supply Current [2] per Input HIGH | $V_{CC}$ = Max., $V_{IN}$ = 3V or $V_{CC}$, f = 0 per Control Input | — | 30 | µA |
| $I_{CCD}$ | Dynamic Power Supply Current per MHz [3] | $V_{CC}$ = 3.3V, A and B Pins Open, Control Input Toggling @ 50% Duty Cycle | — | 0.15 | mA/MHz |

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

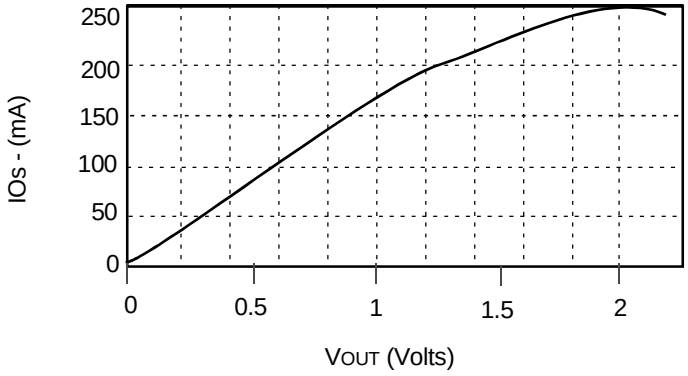
## SWITCHING CHARACTERISTICS OVER OPERATING RANGE[1]

$T_A$ = -40°C to +85°C

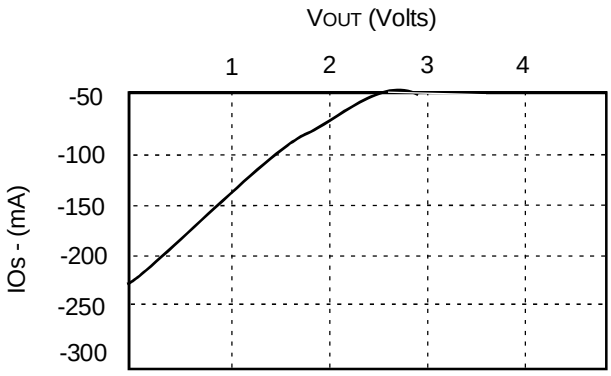
| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| $t_{PLH}$<br>$t_{PHL}$ | Data Propagation Delay[2,3]<br>Ax to/from Bx | —— | — | 0.25 | ns |
| $t_{PZL}$<br>$t_{PZH}$ | Switch Turn-On Delay<br>$\overline{OE}$ to Ax/Bx | 0.5 | — | 6.5 | ns |
| $t_{PLZ}$<br>$t_{PHZ}$ | Switch Turn-Off Delay[2]<br>$\overline{OE}$ to Ax/Bx | 0.5 | — | 4 | ns |

**NOTES:**
1. See TEST CIRCUITS AND WAVEFORMS. Minimums 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 $C_L$ = 30pF. 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.

## OUTPUT VI CHARACTERISTICS

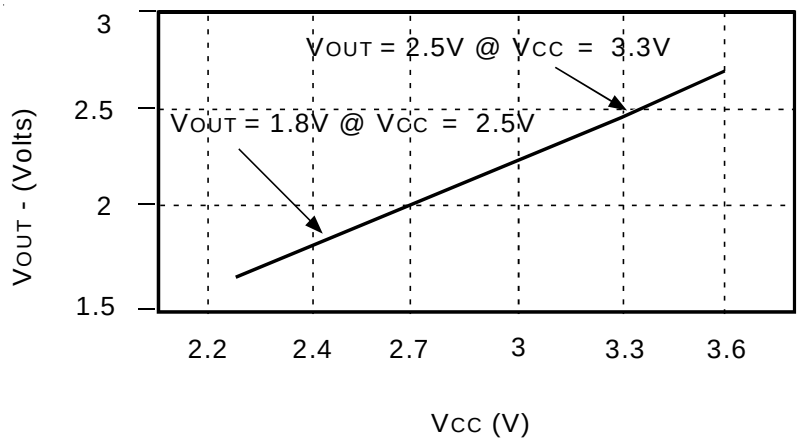



***Outputs Low Characteristic***

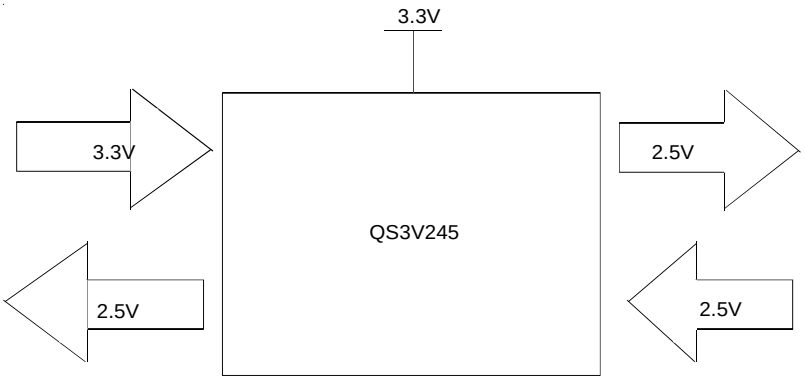


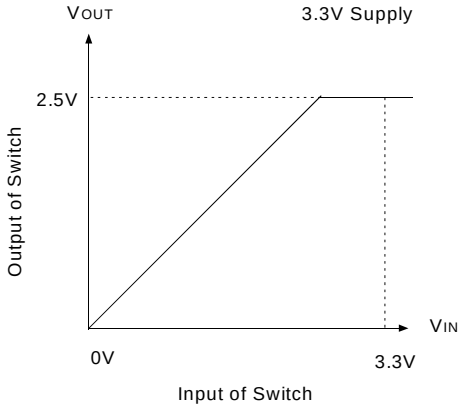

***Outputs High Characteristic***

## PASS VOLTAGE vs VCC

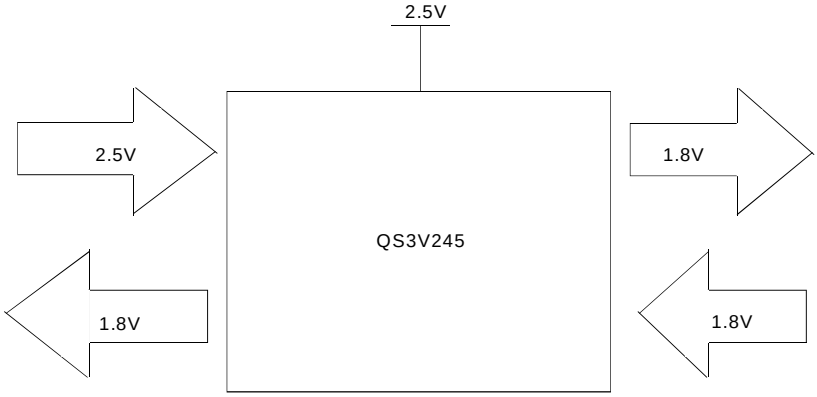


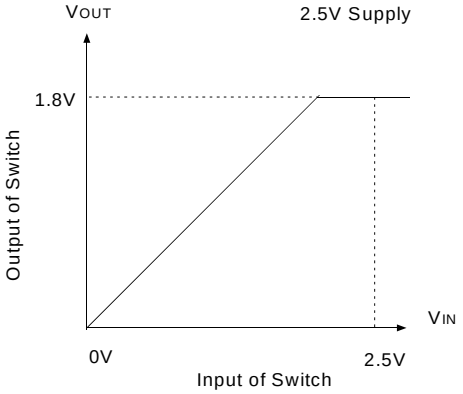
## 3.3V TO 2.5V VOLTAGE TRANSLATION



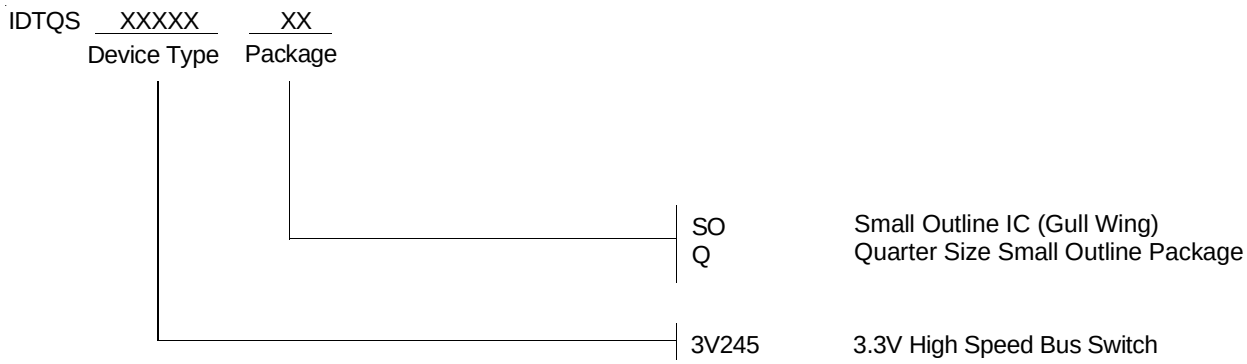




## 2.5V TO 1.8V VOLTAGE TRANSLATION



## ORDERING INFORMATION




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

***for SALES:***
800-345-7015 or 408-727-6116
fax: 408-492-8674
www.idt.com

***for Tech Support:***
logichelp@idt.com
(408) 654-6459