



# QuickSwitch® Products

## 3.3V Quad Active Low Switch for Hot Swap Applications (HotSwitch™)

### FEATURES/BENEFITS

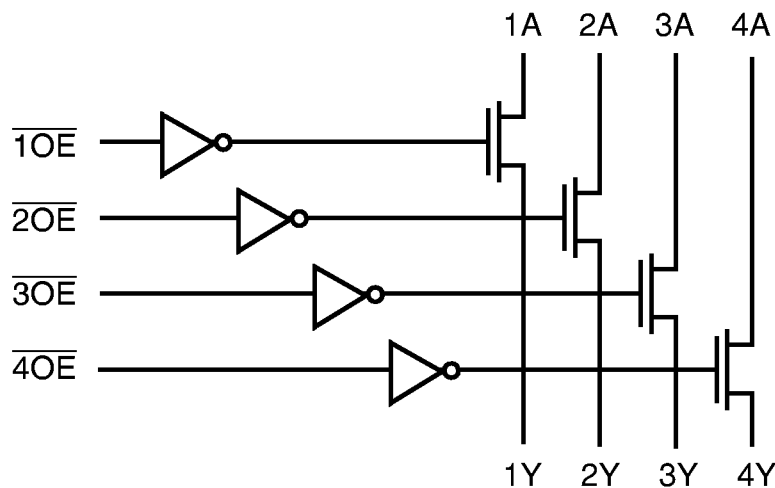
- N channel FET switches with no parasitic diode to  $V_{CC}$ 
  - No DC path to  $V_{CC}$  or GND
  - 5V tolerant in OFF state
- Low  $R_{ON}$  – 4Ω typical
- Flat  $R_{ON}$  characteristics from 0 – 5V
- Bidirectional dataflow with near-zero delay
  - No added ground bounce
- Excellent  $R_{ON}$  matching between channels
- Low capacitance
- Maximum operating frequency for data – 150MHz
- LVTTL-compatible control inputs
- Undershoot clamp diodes on all control and switch inputs
- Available in QSOP and SOIC (S1) packages

### DESCRIPTION

The QS3VH125 HotSwitch Quad bus switch is specially designed for hot-swapping environment. The QS3VH125 has very low ON resistance resulting in under 200ps propagation delay through the switch. The switches can be turned ON under the control of individual LVTTL-compatible active LOW Output Enable signals for bidirectional data flow with no added delay or ground-bounce. In the OFF state, the switches are 5V-tolerant and offer very high impedance at the terminals.

The combination of near-zero propagation delay, high OFF impedance, and over-voltage tolerance makes QS3VH125 ideal for hot swapping applications. The low ON resistance of QS3VH125 makes it ideal for PCI and CompactPCI hot swapping environment.

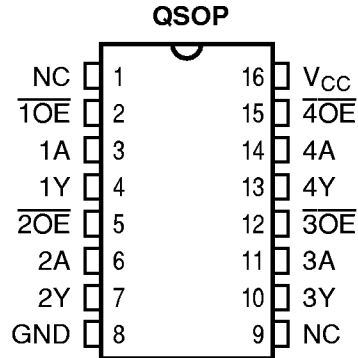
Figure 1. Functional Block Diagram



**Table 1. Pin Description**

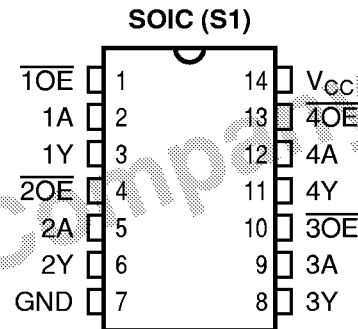
Name	I/O	Description
1A-4A	I/O	Bus A
1Y-4Y	I/O	Bus B
$\overline{1OE-4OE}$	I	Bus Switch Enable

**Figure 2. Pin Configuration**  
(All Pins Top View)



**Table 2. Function Table**

$\overline{OE}$	A	Y	Function
L	H	H	Connect
L	L	L	Connect
H	X	X	Disconnect



**Table 3. Absolute Maximum Ratings**

Supply Voltage to Ground .....	-0.5V to 4.6V
DC Switch Voltage $V_S$ .....	-0.5V to 5.5V
DC Input Voltage $V_{IN}$ .....	-0.5V to 5.5V
AC Input Voltage (for a pulse width $\leq 20$ ns) .....	-3.0V
DC Output Current Max. Sink Current/Pin .....	120mA
Maximum Power Dissipation .....	0.5 watts
$T_{STG}$ Storage Temperature .....	-65° to 150°C

**Note:** ABSOLUTE MAXIMUM CONTINUOUS RATINGS are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute-maximum conditions is not implied.

**Table 4. Capacitance**

$T_A = 25^\circ\text{C}$ ,  $f = 1\text{MHz}$ ,  $V_{IN} = 0\text{V}$ ,  $V_{OUT} = 0\text{V}$

Pins	SOIC, QSOP		Unit
	Typ	Max	
Control Inputs	3	5	pF
QuickSwitch Channels (Switch OFF)	4	6	pF

**Note:** Capacitance is guaranteed, but not production tested and are typical values. For total capacitance while the switch is ON, please see Section 1 under "Input and Switch Capacitance."

**Table 5. DC Electrical Characteristics Over Operating Range**

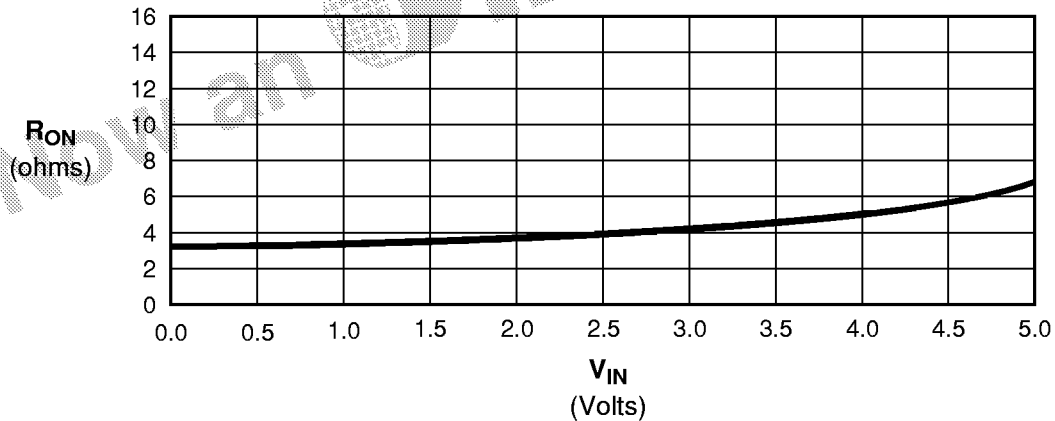
$T_A = -40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ ,  $V_{CC} = 3.3\text{V} \pm 0.3\text{V}$

Symbol	Parameter	Test Conditions	Min	Typ <sup>(1)</sup>	Max	Unit
$V_{IH}$	Input HIGH Voltage	Guaranteed Logic HIGH for Control Pins	2.0	—	—	V
$V_{IL}$	Input LOW Voltage	Guaranteed Logic LOW for Control Pins	—	—	0.8	V
$ I_{IN} $	Input Leakage Current (Control Inputs)	$0\text{V} \leq V_{IN} \leq V_{CC}$	—	—	1	$\mu\text{A}$
$ I_{OZ} $	Off-State Current (Hi-Z)	$0\text{V} \leq V_{OUT} \leq V_{CC}$ , Switches OFF	—	—	1	$\mu\text{A}$
$R_{ON}$	Switch On Resistance <sup>(2,3)</sup>	$V_{CC} = \text{Min.}, V_{IN} = 0.0\text{V}, I_{ON} = 30\text{mA}$ $V_{CC} = \text{Min.}, V_{IN} = 2.4\text{V}, I_{ON} = 15\text{mA}$	—	4	6	$\Omega$
			—	5	8	

**Notes:**

1. Typical values indicate  $V_{CC} = 3.3\text{V}$  and  $T_A = 25^{\circ}\text{C}$ .
2. For a diagram explaining the procedure for  $R_{ON}$  measurement, please see Section 1 under "DC Electrical Characteristics."
3.  $R_{ON}$  guaranteed, but not production tested.

**Figure 3. Typical ON Resistance vs  $V_{IN}$  at  $V_{CC} = 3.3\text{V}$**



**Table 6. Power Supply Characteristics Over Operating Range**

$T_A = -40^\circ\text{C}$  to  $85^\circ\text{C}$ ,  $V_{CC} = 3.3\text{V} \pm 0.3\text{V}$

Symbol	Parameter	Test Conditions <sup>(1)</sup>	Max	Unit
$I_{CCQ}$	Quiescent Power Supply Current	$V_{CC} = \text{Max.}$ , $V_{IN} = \text{GND}$ or $V_{CC}$ , $f = 0$	3.0	mA
$\Delta I_{CC}$	Power Supply Current <sup>(2,3)</sup> per Input HIGH	$V_{CC} = \text{Max.}$ , $V_{IN} = 3.0\text{V}$ , $f = 0$ per control input	30	$\mu\text{A}$
$Q_{CCD}$	Dynamic Power Supply Current per MHz <sup>(4)</sup>	$V_{CC} = \text{Max.}$ , A and Y Pins Open, Controls Inputs Toggling @ 50% Duty Cycle	0.25	mA/MHz

**Notes:**

1. For conditions shown as Min. or Max., use the appropriate values specified under DC specifications.
2. Per LVTTTL driven input. A and Y pins do not contribute to  $\Delta I_{CC}$ .
3. This parameter is guaranteed, but not production tested.
4. This current applies to the control inputs only and represents the current required to switch internal capacitance at the specified frequency. The A and Y inputs generate no significant AC or DC currents as they change states. This parameter is guaranteed, but not production tested.

**Table 7. Switching Characteristics Over Operating Range**

Commercial  $T_A = -40^\circ\text{C}$  to  $85^\circ\text{C}$ ,  $V_{CC} = 3.3\text{V} \pm 0.3\text{V}$

$C_{LOAD} = 50\text{pF}$ ,  $R_{LOAD} = 500\Omega$  unless otherwise noted.

Symbol	Description <sup>(1)</sup>	Min <sup>(4)</sup>	Typ	Max	Unit
$t_{PLH}$ $t_{PHL}$	Data Propagation Delay <sup>(2,3)</sup> A to Y	—	—	0.25	ns
$t_{PZH}$ $t_{PZL}$	Switch Turn-on Delay $\overline{OE}$ to nA/ny	1.5	—	9.0	ns
$t_{PHZ}$ $t_{PLZ}$	Switch Turn-off Delay <sup>(2)</sup> $\overline{OE}$ to nA/ny	1.5	—	8.0	ns
$f_S$	Operating Frequency - Data <sup>(2,5)</sup> $\overline{OE} = \text{LOW}$	—	—	150	MHz
$f_{OE}$	Operating Frequency - Enable <sup>(2,6)</sup>	—	—	10	MHz

**Notes:**

1. See Test Circuit 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 0.20ns for  $C_L = 50\text{pF}$ . Since this time constant is much smaller than the rise/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.
4. Minimums guaranteed, but not production tested.
5. Maximum frequency for bidirectional data flow.
6. Maximum toggle frequency for  $\overline{OE}$  control input.