

## Applications

- 5v to 3.3V translation in mixed supply environment
- Hot Swap interface
- Video, audio switching
- Clock gating
- Logic replacement

## General Description

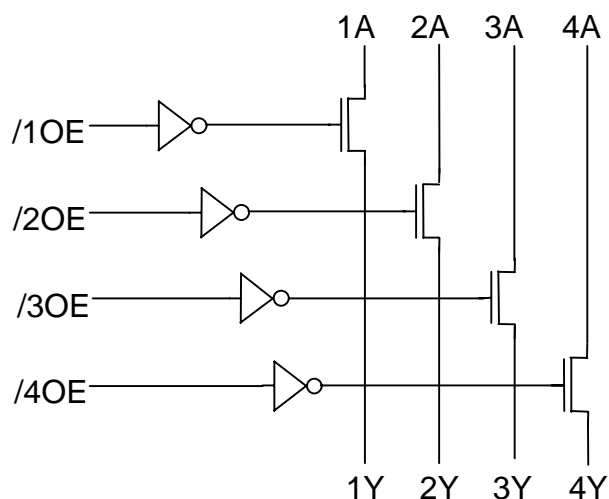
The VS3125 contains a set of four high-speed, low-resistance bus switches. Each bus switch is individually controlled by TTL-compatible, active-low control input (/xOE). The low ON resistance of VS3125 allows inputs to be connected to outputs without adding propagation delay and without generating additional signal noise.

The VS3125 is function and pinout compatible with QS3125. It enables 5V to 3.3V level translation when used with an external diode in the power supply line. In addition, the high off-isolation between switch terminals in the 'disable' mode, and the near-zero propagation delay in the 'on' state make the VS3125 an ideal interface element for hot-swapping applications.

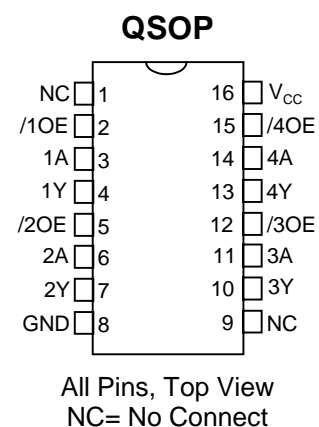
## Features

- Enhanced N-FET with no dc path to  $V_{CC}$  or GND in normal operating signal voltage range.
- Low impedance bidirectional data flow
- Pin-compatible with QS3125 & PI5C3125 switches
- Zero added ground bounce or signal noise
- TTL-compatible control signals
- Near-zero propagation delay
- Undershoot clamp diodes on all switch and control pins
- ESD rating >2000V (Human Body Model) or >200V (Machine Model)
- Latch-up current >100mA
- Available in 150-mil wide QSOP package

**Figure 1. Functional Block Diagram**



**Figure 2. Pin Configuration**



**Table 1. Pin Description**

Name	I/O	Description
1A – 4A	I/O	Data Input or Output
1Y – 4Y	I/O	Data Input or Output
/1OE - /4OE	I	Bus Switch Enable

**Table 2. Function Table**

/xOE	Path	Function
L	xA <-> xY	Enable switch
H	High Impedance	Disable switch

**Table 3. Absolute Maximum Ratings**

Supply Voltage to Ground.....	-0.5V to +7.0V
DC Switch Voltage $V_S$ .....	-0.5V to +7.0V
DC Input Voltage $V_{IN}$ .....	-0.5V to +7.0V
AC Input Voltage (Pulse Width < 20ns).....	-3.0V
DC Output Sink Current per Switch Pin.....	120mA
Maximum Power Dissipation.....	0.5 Watts
Storage Temperature.....	-65°C 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 rated 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	QSOP		Unit
	Typ	Max	
Control Inputs	4	5	pF
VSwitch Channels ( Switch OFF )	5	7	pF

Note Capacitance is guaranteed, but not production tested. Total capacitance of a path, when the switch is closed, is the sum of the switch terminal capacitances.

**Table 5. Recommended Operating Conditions**

Symbol	Parameter	Min	Typ	Max	Units
$V_{CC}$	Power supply voltage	4.5		5.5	V
$V_{IL}$	Low level input voltage (Control inputs)	-0.5		0.8	V
$V_{IH}$	High level input voltage (Control inputs)	2.0		5.5	V
$T_A$	Operating free-air temperature	-40		85	°C

Note: All unused control inputs of the device must be held at  $V_{CC}$  or GND, to ensure proper device operation

**Table 6. Electrical Characteristics Over Recommended Operating Free-air Temperature Range**

Symbol	Parameter	Test Conditions	Min	Typ <sup>(1)</sup>	Max	Units		
V <sub>IK</sub>	Clamp Voltage	Control Inputs	V <sub>CC</sub> = Min., I <sub>IK</sub> = -18mA			-1.5	V	
		Switch I/O				-1.5		
V <sub>OH</sub>	Logic High Voltage V <sub>CC</sub> = 4.3V, V <sub>IN</sub> = 5V	Switch I/O	V <sub>IN</sub> = V <sub>CC</sub> = 5V, I <sub>OUT</sub> = -5μA	3.7	3.9	4.1	V	
			V <sub>CC</sub> = 4.3V, V <sub>IN</sub> = 5V, I <sub>OUT</sub> = -100μA	3.0	3.3	3.6		
I <sub>I</sub>	Input Leakage Current	Control Inputs	V <sub>CC</sub> = Max., V <sub>I</sub> = V <sub>CC</sub> or GND			1	μA	
I <sub>OFF</sub>	Power OFF Leakage Current	Control Inputs	V <sub>CC</sub> = 0, V <sub>I</sub> or V <sub>O</sub> = V <sub>CC</sub> or GND.			1	μA	
		Switch I/O						
I <sub>oz</sub>	OFF State Leakage Current	Switch I/O	V <sub>CC</sub> = Max., V <sub>I/O</sub> = V <sub>CC</sub> , /xOE = V <sub>CC</sub>			1	μA	
I <sub>ODL</sub>	Switch I/O Drive Current (Logic LOW)	V <sub>CC</sub> = Min, V <sub>IN</sub> = 0, V <sub>OUT</sub> = 0.4V			50		mA	
I <sub>ODH</sub>	Switch I/O Drive Current (Logic HIGH)	V <sub>CC</sub> = Min, V <sub>IN</sub> = V <sub>CC</sub> , V <sub>OUT</sub> = 2.4V			-50		mA	
R <sub>ON</sub>	Switch ON Resistance <sup>(2)</sup>	V <sub>CC</sub> = 3.0V, V <sub>IN</sub> = 0, I <sub>OUT</sub> = 15mA				5 <sup>(2)</sup>	7	Ω

**Notes:**

1. Typical value is specified at V<sub>CC</sub> = 5V and T<sub>A</sub> = 25°C.
2. R<sub>ON</sub> is measured by forcing specified current into the 'output' node of the switch with the 'input' node of the switch at the specified voltage.

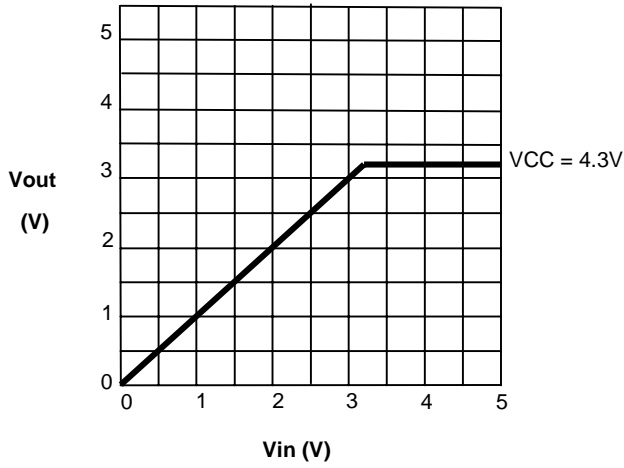
**Table 7. Power Supply Characteristics Over Recommended Operating Free-air Temperature Range**

Symbol	Parameter	Test Conditions <sup>(1)</sup>	Max	Units
I <sub>CCQ</sub>	Quiescent Power Supply Current	V <sub>CC</sub> = Max., /xOE = V <sub>CC</sub> or GND, f = 0	1	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
Q <sub>CCD</sub>	Dynamic Power Supply Current <sup>(3)</sup>	V <sub>CC</sub> = Max, Switch pins open, Control Inputs toggling at 50% duty cycle	0.25	mA/MHz

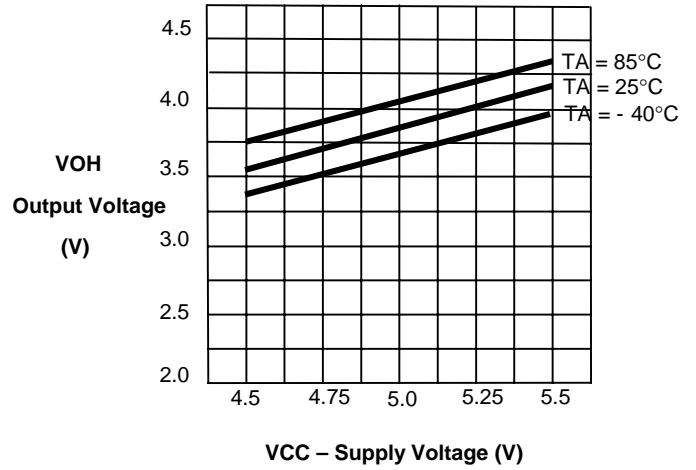
**Notes:**

1. For conditions shown as Min or Max, use the appropriate values specified under Recommended Operating Conditions.
2. Per control input. All other control inputs at GND. Switch I/O pins do not contribute to ΔI<sub>CC</sub>.
3. This parameter represents the average dc current resulting from the switching of internal nodes of the device at a given frequency. The switch I/O pins make insignificant contribution to the dynamic power supply current of the device. This parameter is guaranteed, but not production tested.

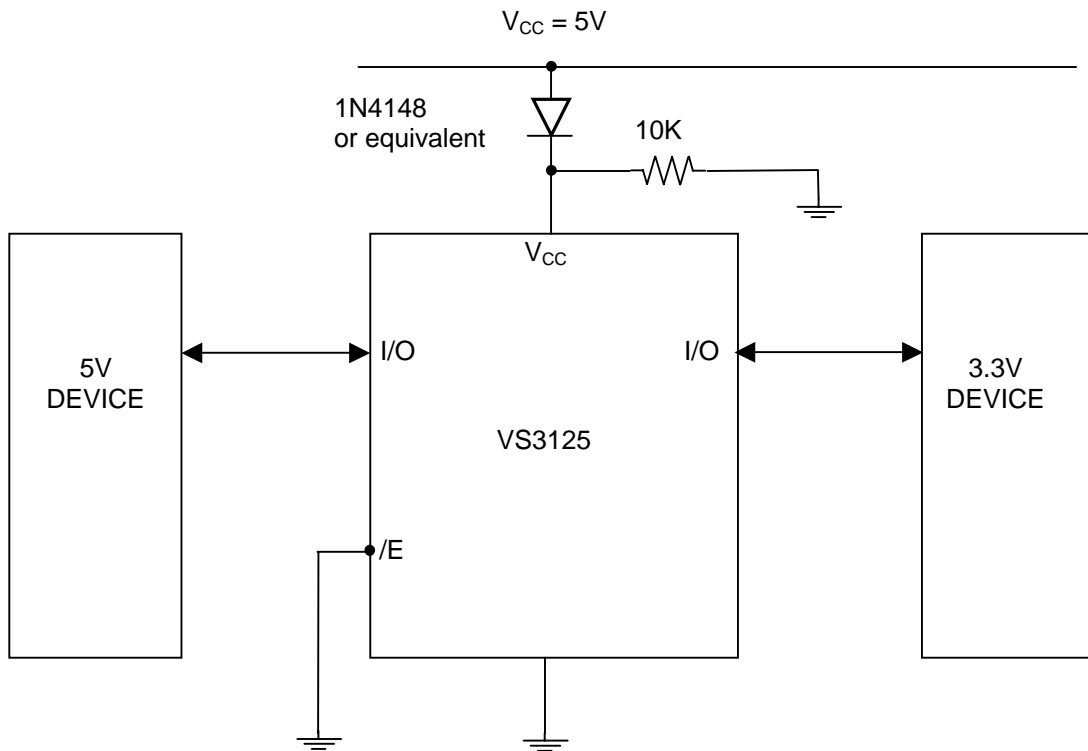
**Figure 3. VOLTAGE TRANSLATION**



**Figure 4. VOH CHARACTERISTICS**



**Figure 5. Voltage Translation. Application**



**Table 8. Switching Characteristics Over Operating Range**

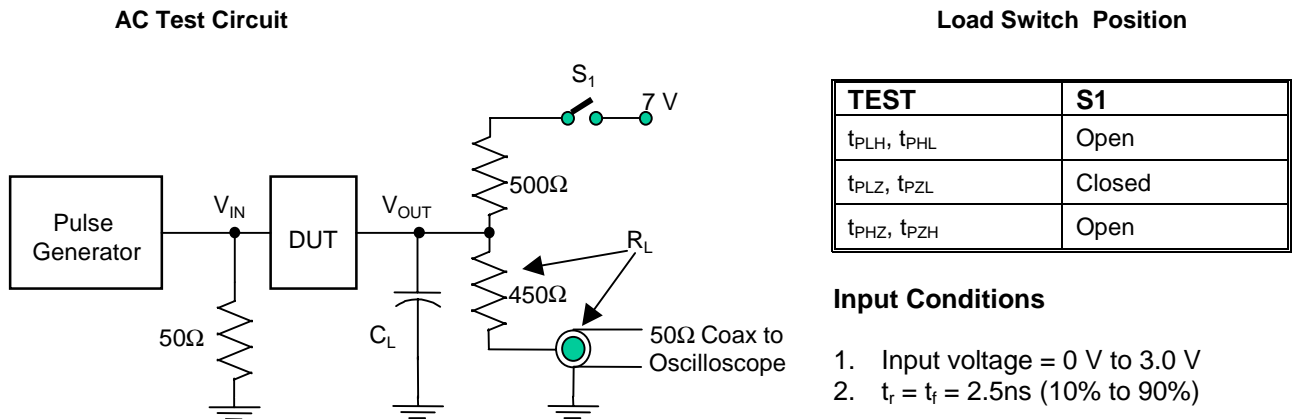
$T_A = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{CC} = 5\text{V} \pm 10\%$   
 $C_{LOAD} = 50\text{pF}$ ,  $R_{LOAD} = 500\Omega$  unless otherwise stated.

Symbol	Description <sup>(1)</sup>	Min <sup>(3)</sup>	Max	Units
$t_{PLH}$ , $t_{PHL}$	Data Propagation Delay <sup>(2,3)</sup> through the switch	-	0.25	ns
$t_{PZH}$ , $t_{PZL}$	Switch Turn-on Delay, /xOE to xA or xY	1.5	6.5	ns
$t_{PLZ}$ , $t_{PHZ}$	Switch Turn-off Delay <sup>(3)</sup> , /xOE to xA or xY	1.5	5.5	ns

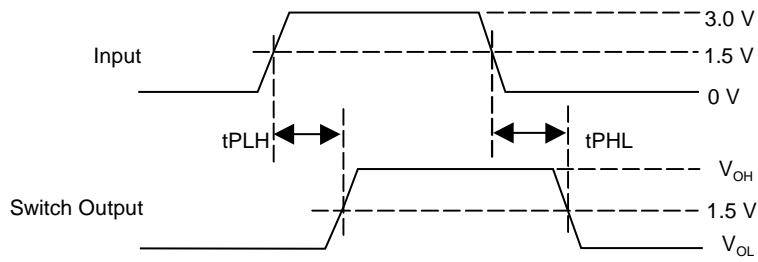
**Notes:**

1. See test circuits and waveforms.
2. This parameter is the calculated theoretical RC time constant of ON-state resistance of the switch and the specified load capacitance when driven by an ideal voltage source (zero source impedance). This time-constant is of the order of 0.25ns for VS3125. Since this time-constant is much smaller than rise/fall times of typical driving signals, it adds very little propagation delay to the system.
3. This parameter is guaranteed, but not production tested.

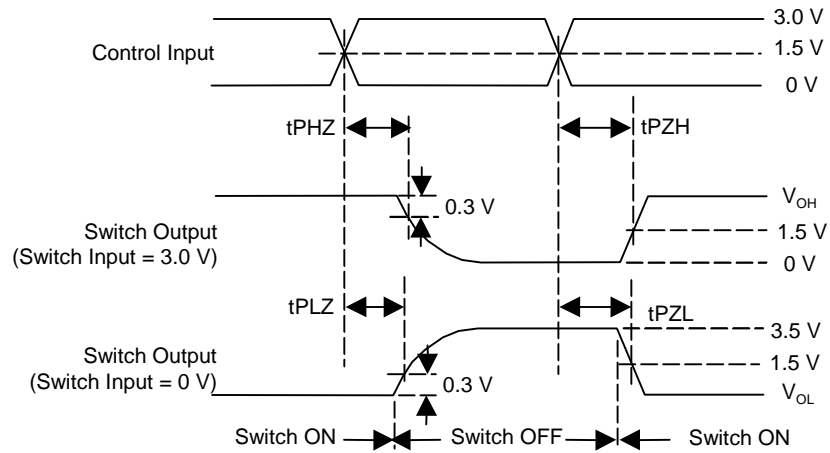
**Figure 6. AC Test Circuit and Switching Waveforms**



## Switching Waveforms



Propagation Delay



Enable and Disable Times

## Ordering Information

Part Number	No. of Pins	Package	Temperature
VS3125Q	16	QSOP	-40°C to +85°C