3.3V Quad Bus Switch with Individual Active Low Enables

Applications

- 3.3v to 2.5V translation
- 2.5V to 1.8V translation
- Hot Swapping
- Bus switching
- Clock gating
- Logic replacement

General Description

The VS3V125 contains a set of four high-speed, low-resistance bus switches. Each bus switch is individually controlled by LVTTL-compatible, active-low control input (/xOE). The low ON resistance of VS3V125 allows inputs to be connected to outputs without adding propagation delay and without generating additional signal noise.

The VS3V125 is designed for 3.3V to 2.5V, or 2.5V to 1.8V level translation, without any external components. 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 VS3V125 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 CBTLV3215 switch
- Zero added ground bounce or signal noise
- LVTTL-compatible control signals
- 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

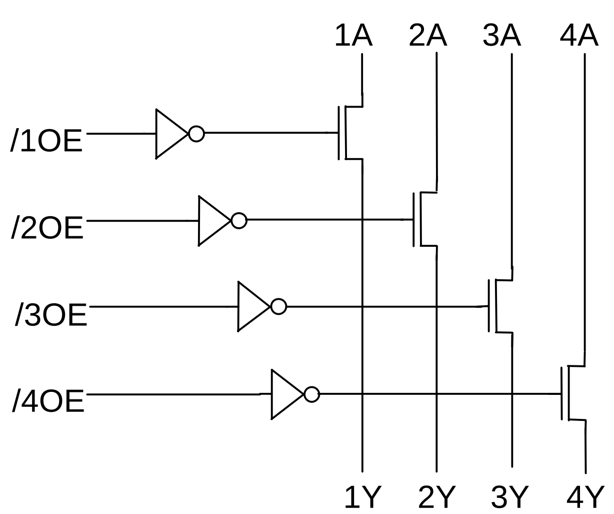
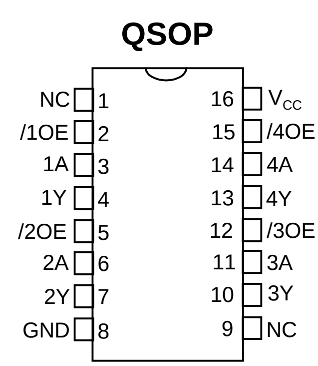


Figure 2. Pin Configuration



All Pins, Top View
NC= No Connect

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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 +4.6V
DC Switch Voltage V_S…………………………………….-0.5V to +4.6V
DC Input Voltage V_{IN}…………………………………...-0.5V to +4.6V
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°C, f = 1MHz, V_{IN} = 0V, V_{OUT} = 0V

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	Conditions	Min	Typ	Max	Units
V_{CC}	Power supply voltage		2.3		3.6	V
V_{IL}	Low level input voltage	Vcc = 2.3 to 2.7			0.7	V
	(Control inputs)	Vcc =2.7 to 3.6			0.8	
V_{IH}	High level input voltage	Vcc = 2.3 to 2.7	1.7			V
	(Control inputs)	Vcc = 2.7 to 3.6	2.0			
T_A	Operating free-air temperature		-40		85	°C

Note: All unused control inputs of the device must be held at Vcc or GND, to ensure proper device operation

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

Symbol	Parameter	Test Conditions		Min	Typ[1]	Max	Units
V_{IK}	Clamp Voltage	Control Inputs	V_{CC} = Min., I_{IK} = -18mA			-1.5	V
		Switch I/O				-1.5	
V_{OH}	Logic High Voltage	Switch I/O	V_{IN} = V_{CC} = 3.3V, I_{OUT} = -100µA	2.3		2.7	V
			V_{IN} = V_{CC} = 2.5V, I_{OUT} = -100µA	1.5		2.0	
I_I	Input Leakage Current	Control Inputs	V_{CC} = Max., V_I = V_{CC} or GND			1	µA
$\|_{OFF}\|$	Power OFF Leakage Current	Control Inputs	V_{CC} = 0, V_I or V_O = V_{CC} or GND.			1	µA
		Switch I/O					
$\|I_{OZ}\|$	OFF State Leakage Current	Switch I/O	V_{CC} = Max., $V_{I/O}$ = V_{CC}, /xOE= V_{CC}			1	µA
I_{ODL}	Switch I/O Drive Current (Logic LOW)	V_{CC} = 3.0V, V_{IN} = 0, V_{OUT} = 0.7V		50			mA
I_{ODH}	Switch I/O Drive Current (Logic HIGH)	V_{CC} = 3.0V, V_{IN} = V_{CC}, V_{OUT} = 1.8V		-50			mA
R_{ON}	Switch ON Resistance[1]	V_{CC} = 3.0V, V_{IN} = 0, I_{OUT} = 15mA			5[2]	7	Ω
		V_{CC} = 2.3V, V_{IN} = 0, I_{OUT} = 8mA			10[3]	14	

Notes:

1. R_{ON} is measured by forcing specified current into the 'output' node of the switch with the 'input' node of the switch at the specified voltage.
2. Typical value is specified at V_{CC} = 3.3V and T_A = 25°C.
3. Typical value is specified at V_{CC} = 2.5V and T_A = 25°C.

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

Symbol	Parameter	Test Conditions [1]	Max	Units
I_{CCQ}	Quiescent Power Supply Current	V_{CC} = Max.,/xOE = V_{CC} or GND, f = 0	1	µA
ΔI_{CC}	Power Supply Current per Input High [2]	V_{CC} = 3.6V, V_{IN} = 3.0V, f = 0	300	µA
		V_{CC} = 2.7V, V_{IN} = 2.0V, f = 0		
Q_{CCD}	Dynamic Power Supply Current [3]	V_{CC} = Max, Switch pins open, Control Inputs toggling at 50% duty cycle	0.15	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_{CC}.
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.

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VOLTAGE TRANSLATION

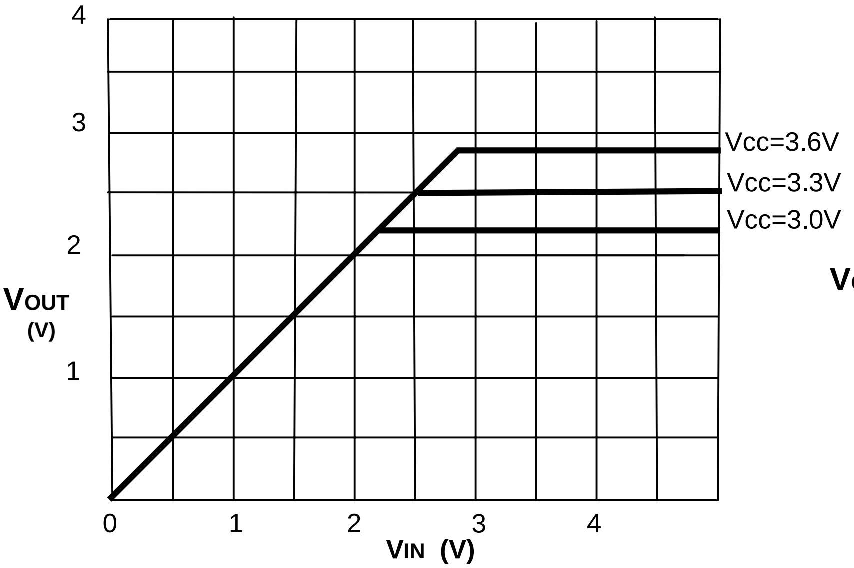


Figure 3. 3.3V to 2.5V Translation
(T_A + 25 °C)

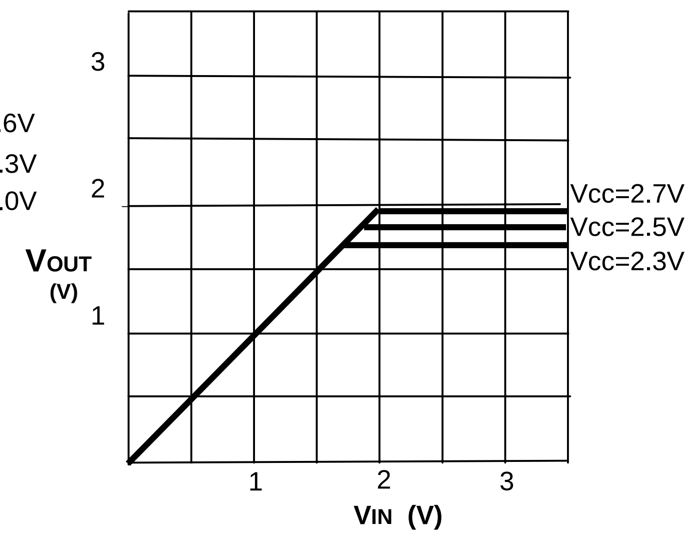


Figure 4. 2.5V to 1.8V Translation
(T_A + 25 °C)

V_{OH} CHARACTERISTICS

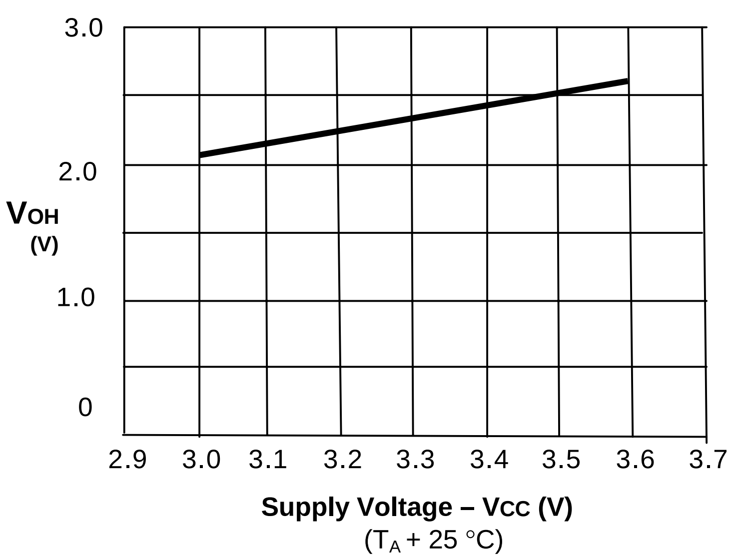


Figure 5. V_{OH} CHARACTERISTICS (Vcc = 3.3V nominal)

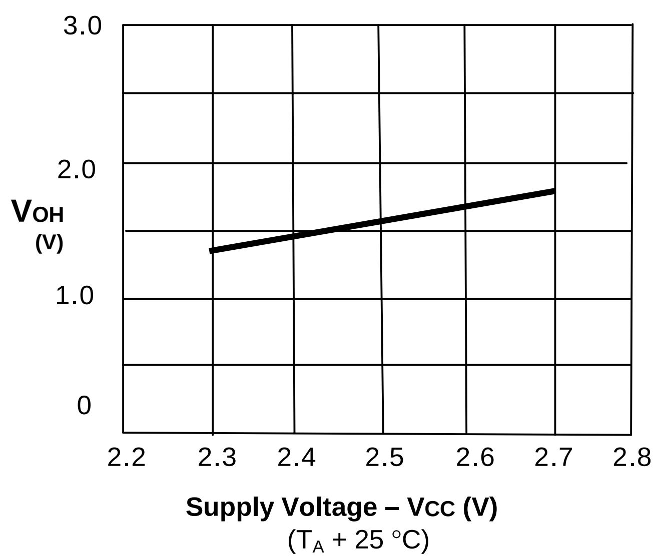


Figure 6. V_{OH} CHARACTERISTICS (Vcc = 2.5V nominal)

Table 8. Switching Characteristics Over Operating Range – 3.3V Supply Voltage

T_A = -40°C to +85°C, V_{CC} = 3.3V ± 5%
C_{LOAD} = 30pF, R_{LOAD} = 500Ω unless otherwise stated.

Symbol	Description [1]	Min[3]	Max	Units
t_{PLH}, t_{PHL}	Data Propagation Delay [2,3] 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 [3], /xOE to xA or xY	1.5	5.5	ns

Table 9. Switching Characteristics Over Operating Range – 2.5V Supply Voltage

T_A = -40°C to +85°C, V_{CC} = 2.5V ± 0.2V
C_{LOAD} = 30pF, R_{LOAD} = 500Ω unless otherwise stated.

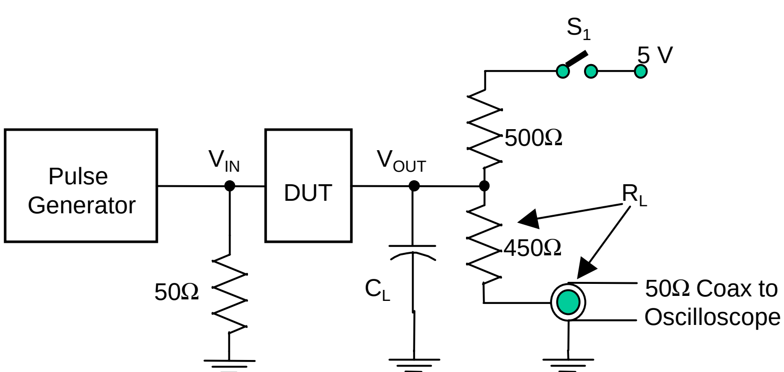
Symbol	Description [1]	Min[3]	Max	Units
t_{PLH}, t_{PHL}	Data Propagation Delay [2,3] through the switch			ns
t_{PZH}, t_{PZL}	Switch Turn-on Delay, , /xOE to xA or xY			ns
t_{PLZ}, t_{PHZ}	Switch Turn-off Delay [3], /xOE to xA or xY			ns

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 VS3V125. 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 5. AC Test Circuit and Switching Waveforms

AC Test Circuit - 3.3V Supply Voltage



Load Switch Position

TEST	S1
t_{PLH}, t_{PHL}	Open
t_{PLZ}, t_{PZL}	Closed
t_{PHZ}, t_{PZH}	Open

Input Conditions

1. Input voltage = 0 V to 3.0 V
2. $t_r = t_f$ = 2.5ns (10% to 90%)

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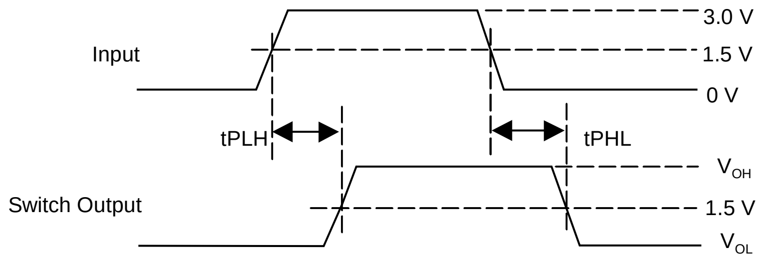
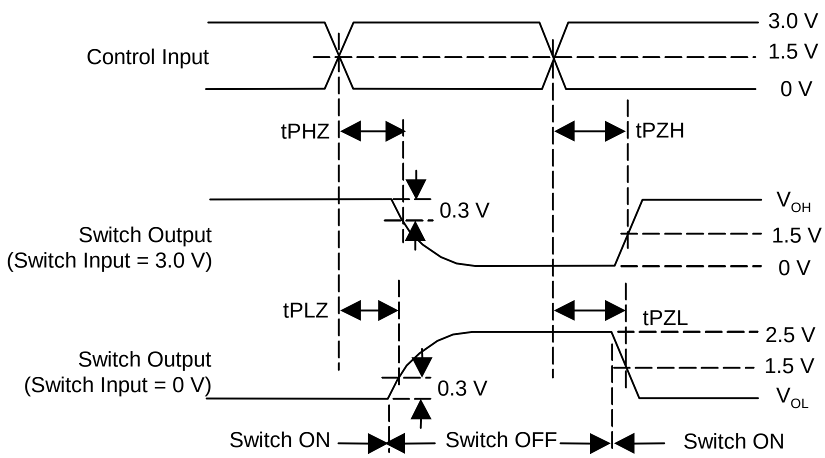
Switching Waveforms



Propagation Delay



Enable and Disable Times

Ordering Information

Part Number	Markings	Shipping/Packaging	No. of Pins	Package	Temperature
VS3V125Q	VS3V125Q	Tubes	16	QSOP	-40°C to +85°C
VS3V125QX	VS3V125Q	Tape & Reel	16	QSOP	-40°C to +85°C

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