

## Applications

- 5V to 3.3V translation in mixed-supply environment
- Hot-swap interface
- Logic replacement
- Memory bank, video, & audio switching
- Power conservation

## General Description

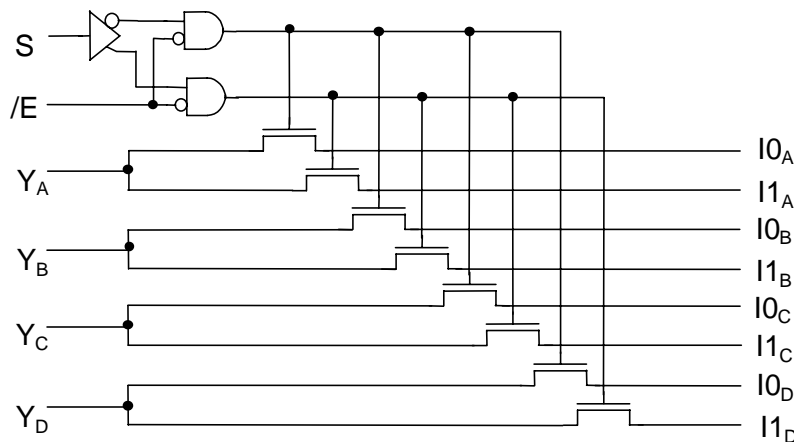
The VS3257 is a high-speed TTL-compatible Quad 2:1 multiplexer/demultiplexer. The VS3257 contains four mux/demux channels, with a common path control (S) and active low enable (/E). The low ON resistance of the VS3257 allows inputs to be connected to outputs, without adding propagation delay and without generating additional signal noise. The VS32257 has 25Ω resistors in series with the switches to reduce ground-bounce noise and signal reflection.

The VS3257 and VS32257 mux/demux switches are function and pinout compatible with QS3257 and CBT3257 switches. They enable 5V to 3.3V translation when used with an external diode in the power supply line. In addition, the high off-isolation in the 'disable' mode makes VS3257 and VS32257 ideal interface elements for hot-swap applications.

## Features

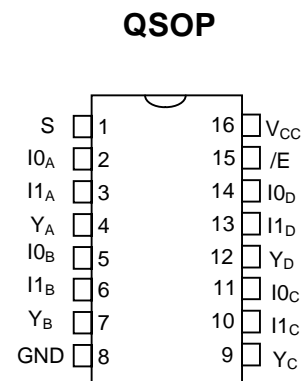
- Enhanced N-FET with no DC path to  $V_{CC}$  or GND in normal operating signal voltage range.
- Low impedance bidirectional data flow: 5Ω (VS3257) and 25Ω (VS32257)
- Pin-compatible with QS3257 and CBT3257 switches.
- Near zero propagation delay
- Zero added ground bounce or signal noise
- Break-before-make feature
- TTL-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)



**Table 1. Pin Description**

Name	I/O	Description
IO <sub>X</sub> , I1 <sub>X</sub>	I/O	Data Input or Output
S	I	Select Input
/E	I	Enable Input
Y <sub>A</sub> - Y <sub>D</sub>	I/O	Data Output or Input

**Table 2. Function Table**

Inputs		Path	Function
/E	S		
H	X	Hi Impedance	Disable all switches
L	L	IO <sub>X</sub> <-> Y <sub>X</sub>	Select 0
L	H	I1 <sub>X</sub> <-> Y <sub>X</sub>	Select 1

**Table 3. Absolute Maximum Ratings**

Supply Voltage to Ground.....	-0.5V to +7.0V
DC Switch Voltage V <sub>S</sub> .....	-0.5V to +7.0V
DC Input Voltage V <sub>IN</sub> .....	-0.5V to +7.0V
AC Input Voltage (Pulse Width < 20ns).....	-3.0V
DC Output Sink Current per Switch Pin.....	120 mA
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. Correct functional operation while operating in the absolute maximum rated conditions is not implied.

**Table 4. Capacitance**

T<sub>A</sub> = 25°C, f = 1 MHz, V<sub>IN</sub> = 0V, V<sub>OUT</sub> = 0V

Pins	Operation	QSOP		Unit
		Typ	Max	
Control Inputs		4	5	pF
VSwitch Channels (Switch OFF)	Demux	5	7	pF
	Mux	7	8	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 <sub>CC</sub>	Power supply voltage		4.5		5.5	V
V <sub>IL</sub>	Low level input voltage		-0.5		0.8	V
V <sub>IH</sub>	High level input voltage		2.0		5.5	V
T <sub>A</sub>	Operating free-air temperature		-40		85	°C

**Note:**

- All unused control inputs of the device must be held at V<sub>CC</sub> 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> = -18 mA			-1.5	V
		Switch I/O				-1.5	
V <sub>OH</sub>	Logic High Voltage	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>N</sub> = 5V, I <sub>OUT</sub> = -5μA	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> , /E = 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	VS3257	50			mA
			VS32257				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	VS3257	-50			mA
			VS32257				mA
R <sub>ON</sub>	Switch ON Resistance <sup>(2)</sup>	V <sub>CC</sub> = Min, V <sub>IN</sub> = 0, I <sub>OUT</sub> = 30mA	VS3257		5	7	Ω
			VS32257	20	28	40	Ω

**Notes:**

- Typical values are specified at V<sub>CC</sub> = 5.0V and T<sub>A</sub> = 25°C.
- 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, S, /E = V <sub>CC</sub> or GND, f = 0	1	μA
ΔI <sub>CC</sub>	Power Supply Current per Input High (Control Inputs) <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:**

- For conditions shown as Min or Max, use the appropriate values per *Recommended Operating Conditions*.
- Per TTL-driven control input. All other control inputs at GND. Switch I/O pins do not contribute to ΔI<sub>CC</sub>.
- 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

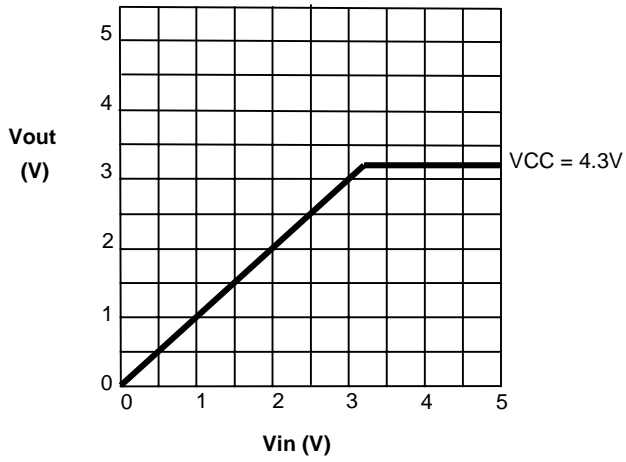


Figure 4. VOH CHARACTERISTICS

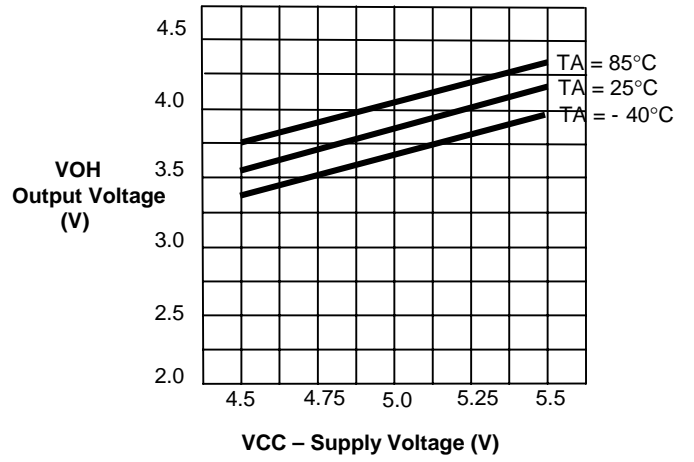
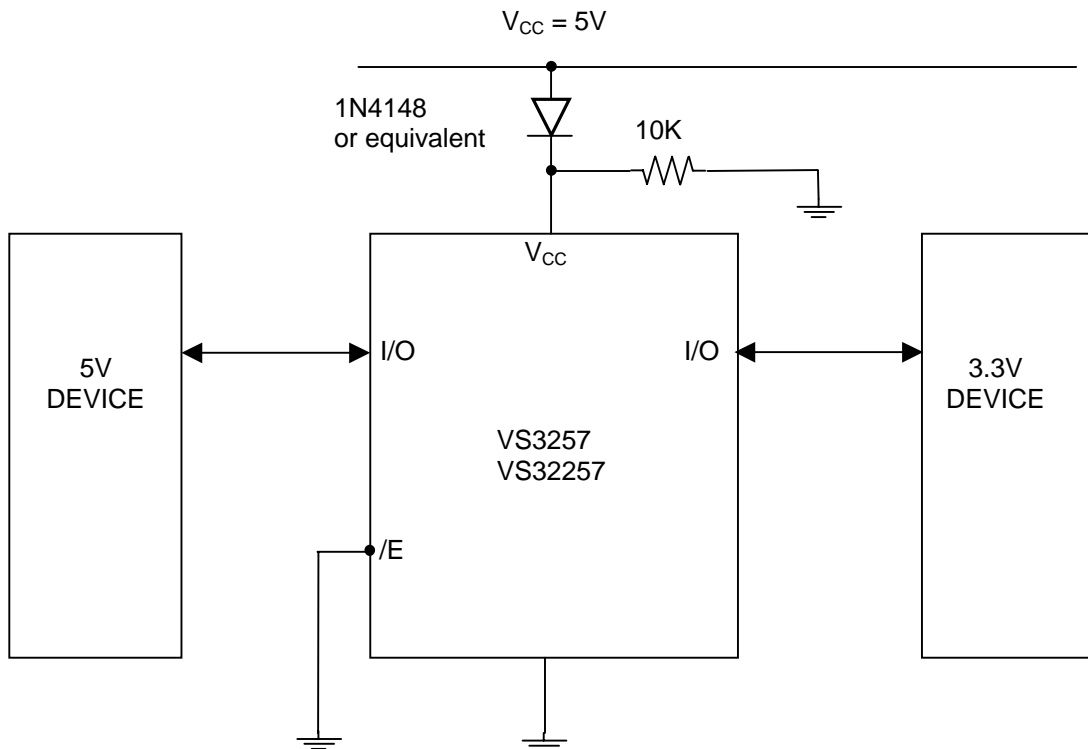


Figure 5. Voltage Translation. Application



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

$T_A = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 10\%$   
 $C_{LOAD} = 50\text{pF}$ ,  $R_{LOAD} = 500\Omega$  unless otherwise stated.

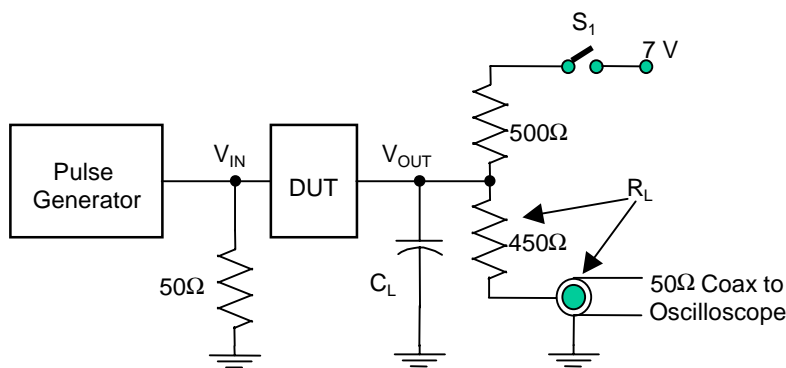
Symbol	Description <sup>(1)</sup>	VS3257		VS32257		Units
		Min <sup>(3)</sup>	Max	Min <sup>(3)</sup>	Max	
$t_{PLH}$ , $t_{PHL}$	Data Propagation Delay <sup>(2,3)</sup> through the switch		0.25		1.25	ns
$t_{PZH}$ , $t_{PZL}$	Switch Turn-on Delay, S to $Y_x$ , $I0_x$ , or $I1_x$	0.5	5.2	0.5	6.2	ns
$t_{PZH}$ , $t_{PZL}$	Switch Turn-on Delay, /E to $Y_x$ , $I0_x$ , or $I1_x$	0.5	4.8	0.5	5.8	ns
$t_{PLZ}$ , $t_{PHZ}$	Switch Turn-off Delay <sup>(3)</sup> , S or /E to $Y_x$ , $I0_x$ , or $I1_x$	0.5	5.0	0.5	5.0	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 on the order of 0.25 ns for VS3257 and 1.25 ns for VS32257. 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**

**AC Test Circuit**



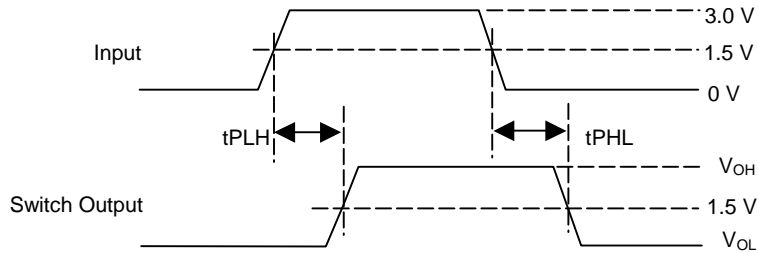
**Load Switch Position**

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

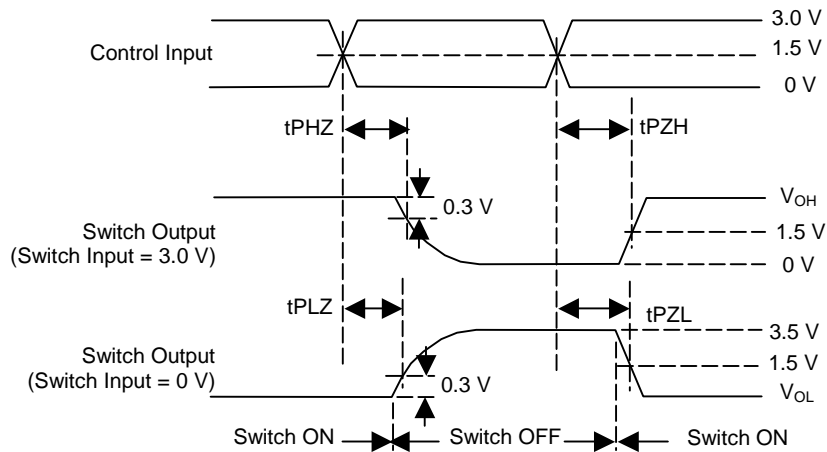
**Input Conditions**

Input voltage = 0 V to 3.0 V  
 $t_r = t_f = 2.5\text{ns}$  (10% to 90%)

Switching Waveforms



Propagation Delay



Enable and Disable Times

Ordering Information

Part Number	No. of Pins	Package	Temperature
VS3257Q	16	QSOP	-40°C to +85°C
VS32257Q	16	QSOP	-40°C to +85°C