



QUICKSWITCH® PRODUCTS 2.5V / 3.3V 8:1 MUX/DEMUX HIGH BANDWIDTH BUS SWITCH

IDTQS3VH251

FEATURES:

- **N channel FET switches with no parasitic diode to Vcc**
 - Isolation under power-off conditions
 - No DC path to Vcc or GND
 - 5V tolerant in OFF and ON state
- **5V tolerant I/Os**
- **Low R_{ON} - 4Ω typical**
- **Flat R_{ON} characteristics over operating range**
- **Rail-to-rail switching 0 - 5V**
- **Bidirectional dataflow with near-zero delay: no added ground bounce**
- **Excellent R_{ON} matching between channels**
- **Vcc operation: 2.3V to 3.6V**
- **High bandwidth - up to 500MHz**
- **LVTTL-compatible control Inputs**
- **Undershoot Clamp Diodes on all switch and control Inputs**
- **Low Demux capacitance, 4pF typical**
- **Available in QSOP and TSSOP packages**

APPLICATIONS:

- Hot-swapping
- Multiplexing/demultiplexing
- Low distortion analog switch
- Replaces mechanical relay
- ATM 25/155 switching

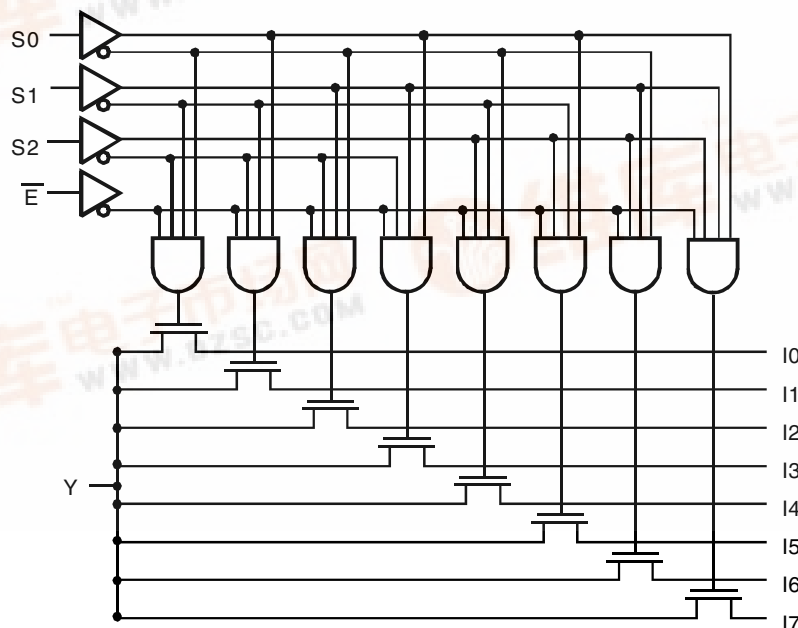
DESCRIPTION:

The QS3VH251 HotSwitch Quad 2:1 multiplexer/demultiplexer is a high bandwidth bus switch. The QS3VH251 has very low ON resistance, resulting in under 250ps propagation delay through the switch. The Select (Sx) input controls the data flow. The multiplexers/demultiplexers are enabled when the Enable ($\bar{E}$) input is low. In the ON state, the switches can pass signals up to 5V. In the OFF state, the switches offer very high impedance at the terminals.

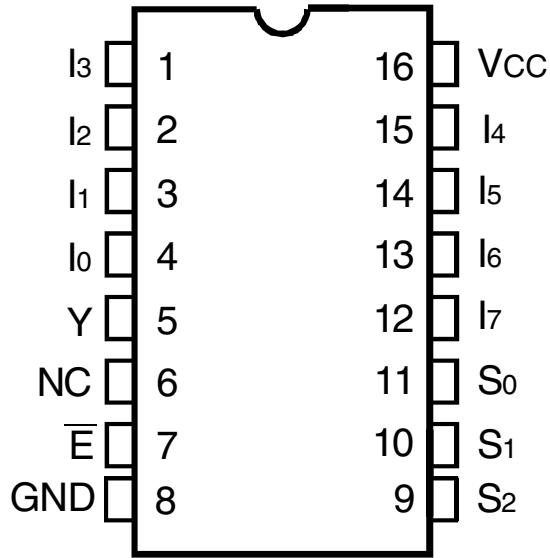
The combination of near-zero propagation delay, high OFF impedance, and over-voltage tolerance makes the QS3VH251 ideal for high performance communication applications.

The QS3VH251 is characterized for operation from -40°C to +85°C.

FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATION



QSOPTSSOP
TOP VIEW

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

Symbol	Description	Max	Unit
VTERM ⁽²⁾	Supply Voltage to Ground	-0.5 to +4.6	V
VTERM ⁽³⁾	DC Switch Voltage Vs	-0.5 to +5.5	V
VTERM ⁽³⁾	DC Input Voltage VIN	-0.5 to +5.5	V
VAC	AC Input Voltage (pulse width ≤20ns)	-3	V
IOUT	DC Output Current (max. sink current/pin)	120	mA
TSTG	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. Vcc terminals.

3. All terminals except Vcc .

CAPACITANCE (TA = +25°C, F = 1MHz, VIN = 0V, VOUT = 0V)

Symbol	Parameter ⁽¹⁾	Typ.	Max.	Unit
CIN	Control Inputs	3	5	pF
CI/O	Quickswitch Channels (Switch OFF)	Demux	4	pF
		Mux	19	
CI/O	Quickswitch Channels (Switch ON)	Demux	20	pF
		Mux	20	

NOTE:

1. This parameter is guaranteed but not production tested.

FUNCTION TABLE⁽¹⁾

E-bar	Select			Y	Function
	S2	S1	S0		
H	X	X	X	Z	Disable
L	L	L	L	I0	S2 - S0 = 0
L	L	L	H	I1	S2 - S0 = 1
L	L	H	L	I2	S2 - S0 = 2
L	L	H	H	I3	S2 - S0 = 3
L	H	L	L	I4	S2 - S0 = 4
L	H	L	H	I5	S2 - S0 = 5
L	H	H	L	I6	S2 - S0 = 6
L	H	H	H	I7	S2 - S0 = 7

NOTE:

1. H = HIGH Voltage Level

L = LOW Voltage Level

X = Don't Care

Z = High-Impedence

PIN DESCRIPTION

Pin Names	I/O	Description
I0 - I7	I	Data Inputs
S0 - S2	I	Select Input
E-bar	I	Enable Input
Y	O	Data Outputs

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

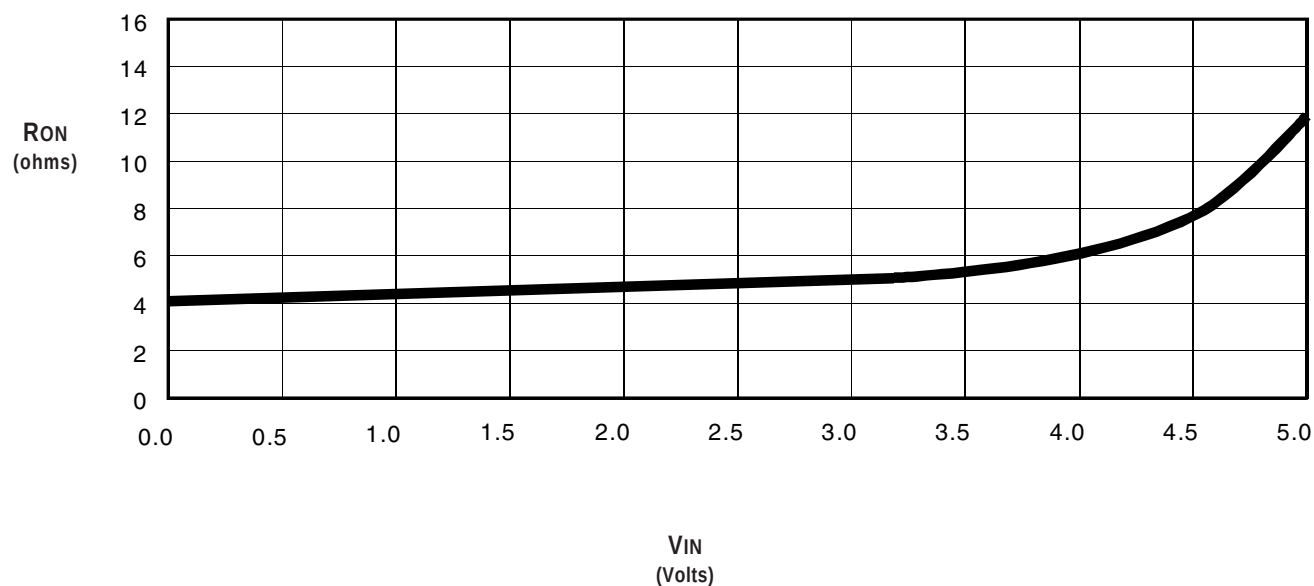
Industrial: $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $V_{CC} = 3.3\text{V} \pm 0.3\text{V}$

Symbol	Parameter	Test Conditions			Min.	Typ. ⁽¹⁾	Max.	Unit
V_{IH}	Input HIGH Voltage	Guaranteed Logic HIGH for Control Inputs	$V_{CC} = 2.3\text{V}$ to 2.7V		1.7	—	—	V
			$V_{CC} = 2.7\text{V}$ to 3.6V		2	—	—	
V_{IL}	Input LOW Voltage	Guaranteed Logic LOW for Control Inputs	$V_{CC} = 2.3\text{V}$ to 2.7V		—	—	0.7	V
			$V_{CC} = 2.7\text{V}$ to 3.6V		—	—	0.8	
I_{IN}	Input Leakage Current (Control Inputs)	$0\text{V} \leq V_{IN} \leq V_{CC}$			—	—	± 1	μA
I_{OZ}	Off-State Current (Hi-Z)	$0\text{V} \leq V_{OUT} \leq 5\text{V}$, Switches OFF			—	—	± 1	μA
I_{OFF}	Data Input/Output Power Off Leakage	V_{IN} or V_{OUT} 0V to 5V , $V_{CC} = 0\text{V}$			—	—	± 1	μA
R_{ON}	Switch ON Resistance	$V_{CC} = 2.3\text{V}$ Typical at $V_{CC} = 2.5\text{V}$	$V_{IN} = 0\text{V}$	$I_{ON} = 30\text{mA}$	—	6	8	Ω
			$V_{IN} = 1.7\text{V}$	$I_{ON} = 15\text{mA}$	—	7	9	
		$V_{CC} = 3\text{V}$	$V_{IN} = 0\text{V}$	$I_{ON} = 30\text{mA}$	—	4	6	
			$V_{IN} = 2.4\text{V}$	$I_{ON} = 15\text{mA}$	—	5	8	

NOTE:

1. Typical values are at $V_{CC} = 3.3\text{V}$ and $T_A = 25^{\circ}\text{C}$.

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



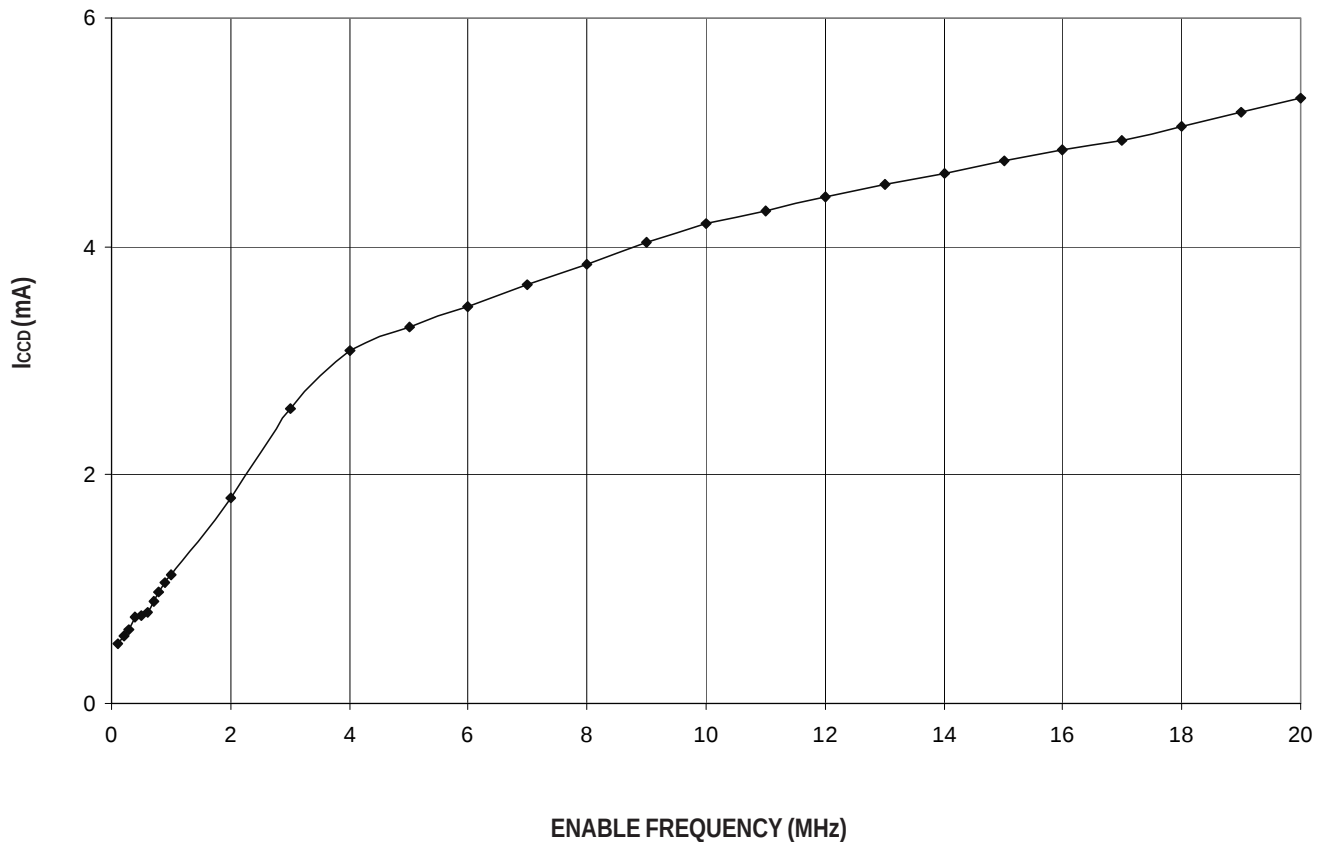
POWER SUPPLY CHARACTERISTICS

Symbol	Parameter	Test Conditions ⁽¹⁾	Min.	Typ.	Max.	Unit
I _{CCQ}	Quiescent Power Supply Current	V _{CC} = Max., V _{IN} = GND or V _{CC} , f = 0	—	1	4	mA
ΔI _{CC}	Power Supply Current ^(2,3) per Input HIGH	V _{CC} = Max., V _{IN} = 3V, f = 0 per Control Input	—	—	30	μA
I _{CCD}	Dynamic Power Supply Current ⁽⁴⁾	V _{CC} = 3.3V, A and B Pins Open, Control Inputs Toggling @ 50% Duty Cycle	See Typical I _{CCD} vs Enable Frequency graph below			

NOTES:

1. For conditions shown as Min. or Max., use the appropriate values specified under DC Electrical Characteristics.
2. Per input driven at the specified level. Mux/demux pins do not contribute to ΔI_{CC}.
3. This parameter is guaranteed but not tested.
4. This parameter represents the current required to switch internal capacitance at the specified frequency. The mux/demux inputs do not contribute to the Dynamic Power Supply Current. This parameter is guaranteed but not production tested.

TYPICAL I_{CCD} vs ENABLE FREQUENCY CURVE AT V_{CC} = 3.3V



SWITCHING CHARACTERISTICS OVER OPERATING RANGE

 $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$

Symbol	Parameter	$V_{CC} = 2.5 \pm 0.2\text{V}^{(1)}$		$V_{CC} = 3.3 \pm 0.3\text{V}^{(1)}$		Unit
		Min. ⁽⁴⁾	Max.	Min. ⁽⁴⁾	Max.	
t_{PLH} t_{PHL}	Data Propagation Delay ^(2,3) Y to Ix or Ix to Y	—	0.2	—	0.2	ns
t_{SEL}	Select Time Sx to Y	1.5	9	1.5	8	ns
t_{PZH} t_{PZL}	Enable Time S to Ix	1.5	9	1.5	9	ns
t_{PHZ} t_{PLZ}	Disable Time S to Ix	1.5	8	1.5	8	ns
t_{PZH} t_{PZL}	Enable Time $\bar{E}$ to Y or Ix	1.5	9	1.5	8	ns
t_{PHZ} t_{PLZ}	Disable Time $\bar{E}$ to Y or Ix	1.5	8	1.5	8	ns
f_{EorSx}	Operating Frequency - Enable ^(2,5)	—	10	—	20	MHz

NOTES:

1. See Test Conditions under TEST CIRCUITS AND WAVEFORMS.

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 0.2ns at $C_L = 50\text{pF}$. 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.

4. Minimums are guaranteed but not production tested.

5. Maximum toggle frequency for Sx or $\bar{E}$ control input (pass voltage $> V_{CC}$, $V_{IN} = 5\text{V}$, $R_{LOAD} \geq 1\text{M}\Omega$, no C_{LOAD}).

SOME APPLICATIONS FOR HOTSWITCH PRODUCTS

Rail-to-Rail Switching

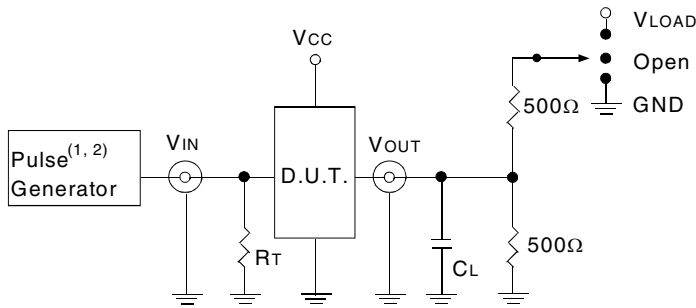
Multiplexing/Demultiplexing

Hot-Swapping

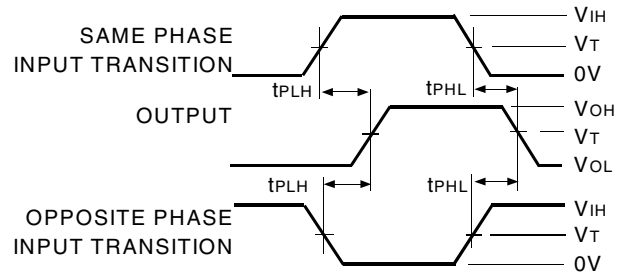
TEST CIRCUITS AND WAVEFORMS

TEST CONDITIONS

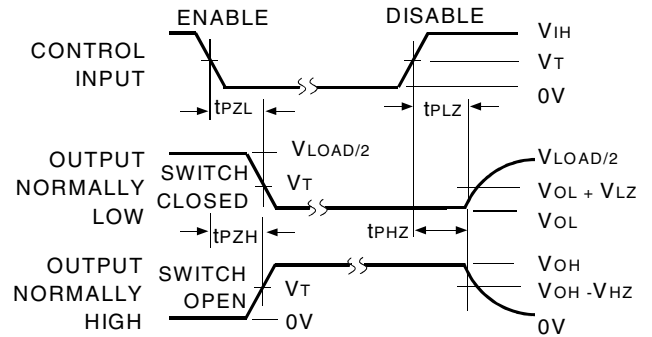
Symbol	$V_{CC}^{(1)} = 3.3V \pm 0.3V$	$V_{CC}^{(2)} = 2.5V \pm 0.2V$	Unit
V_{LOAD}	6	$2 \times V_{CC}$	V
V_{IH}	3	V_{CC}	V
V_T	1.5	$V_{CC}/2$	V
V_{LZ}	300	150	mV
V_{HZ}	300	150	mV
C_L	50	30	pF



Test Circuits for All Outputs



Propagation Delay



NOTE:

1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.

Enable and Disable Times

DEFINITIONS:

C_L = Load capacitance: includes jig and probe capacitance.

R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.

NOTES:

1. Pulse Generator for All Pulses: Rate $\leq 10\text{MHz}$; $t_r \leq 2.5\text{ns}$; $t_f \leq 2.5\text{ns}$.

2. Pulse Generator for All Pulses: Rate $\leq 10\text{MHz}$; $t_r \leq 2\text{ns}$; $t_f \leq 2\text{ns}$.

SWITCH POSITION

Test	Switch
t_{PLZ}/t_{PZL}	V_{LOAD}
t_{PHZ}/t_{PZH}	GND
t_{PD}	Open

ORDERING INFORMATION

IDTQS	XXXXX	XX		
	Device Type	Package		
			Q	Quarter Size Outline Package
			QG	QSOP - Green
			PA	Thin Shrink Small Outline Package
			3VH251	2.5V / 3.3V 8:1 Mux/Demux High Bandwidth Bus Switch

DATA SHEET DOCUMENT HISTORY

8/6/2002 Updated according to PCN Logic-0206-11



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